The

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# Researches on Circuit-Breaking.

THE extremely interesting paper read before the Institution of Electrical Engineers on Thursday, last week, by Messrs. Wedmore, Whitney, and Bruce—a report of the Electrical Research Association—may be regarded as the first instalment of the revelations with regard to circuit-breaking which have been foreshadowed in some of the Association's annual reports. Whilst the results obtained have doubtless been known for some time to the manufacturing firms which are members of the Association, the industry in general has awaited them with interested anticipation—and it has not been disappointed. Although this paper is described as only an introductory one, the first of a series that will be required to deal adequately with the subject, it contains so much material that is new and useful, that in itself it constitutes a valuable addition to our knowledge of the art. It includes a number of highly suggestive ideas, and it is hinted that letters patent are being sought as a result of the work done. Having regard to the importance of the paper, the discussion which took place at the Institution was disappointing; a few well-known specialists took part in it, but it petered out for want of speakers. Nevertheless, we have no doubt that the paper will be closely studied, and will bear fruit in practice.

Next to the heating of buried cables, which the Association has already dealt with to great advantage, there is probably no subject so important to the electrical industries as that of circuit-breaking. The cost of heavy switchgear is out of proportion to that of other plant components, yet it still remains the weakest and least trustworthy link in the chain of transmission from coal-pile to consumer. The authors suggest that its backward stage of evolution is due to the fact that designers have treated the arc at rupture as though it were a conflagration which must be extinguished, instead of realising that it naturally goes out twice in every cycle, and *can probably be prevented from re-starting*. This seems to be a logical and scientific line of attack, and the authors claim that the whole of their work shows "that the weight of the attack on the arc has, in the past, been thrown in the wrong

direction." The research was begun six years ago, and has involved an enormous amount of labour; so many variables are involved in the complex problem of circuit-breaking, that large numbers of tests are necessary to establish each observation. The ingenious methods adopted to study in detail the phenomena that took place, and the conditions that were set up when the current-carrying contacts were separated, command our admiration, and the critical analysis of the results is no less commendable. The fact that it has been found possible to rupture arcs of 7,000 amperes at 5,500 volts in air, with a single gap not exceeding $\frac{3}{4}$ in., in a highly inductive circuit, alone suffices to indicate the value of the work and the progress made; and whilst we commend the present paper to the perusal of all who are interested in the subject, we look forward with avidity to the further communications that are promised. We have consistently urged that the Association should command, as it has certainly deserved, the generous support of the industry with financial resources, to enable it to continue and to expedite its investigations, and we once more invite not only manufacturers, but also users of electrical apparatus to realise that it is in their own interests to sow in this fertile field—they will reap a rich harvest.

**Looking Forward.**

Though this is our last issue for 1928, it is not our intention to indulge in detailed reflections on the course of trade during the past twelve months, as there have been frequent other occasions for doing so. The changes and developments that have been taking place will be continued and probably carried further during 1929, and their consolidation will bring new experience and, we hope, beneficial results within the industry, and larger trade both at Home and overseas. In the electricity supply department we may anticipate gratifying progress, particularly in domestic and kindred applications; the requirements of the Central Electricity Board should be substantial; and if revival in our general industries actually arrives, various sections of electrical manufacturing will reap benefit. In past years we have regarded General Elections as lengthy trade-disturbing factors, but to-day they do not spread their effect over so long a period. Indeed, so far as electricity is concerned, it is unlikely to occupy a large place in future legislation, and therefore may not be made the sport of party politicians in the contest that is expected to take place in the late spring or early summer. The Acts already on the Statute Books and the powers of the Electricity Commission will call for executive activity rather than political oratory for 1929 and many succeeding years. Any unsettlement caused by a General Election is generally greater in advance of the actual event than after it, whichever party may gain at the polls. The development of the spirit of conciliation in industry and the setting up of machinery necessitated to ensure and facilitate its execution, may be amongst the great tasks before us, and trade policy will be further under discussion in relation to the serious unemployment and employment transference problem. We shall do well if we look forward hopefully to the making of real progress toward the happy and successful conclusion of these matters, for hopeless industry is lost industry. We have every confidence in wishing all connected with the electrical profession and industry a happy and prosperous New Year.

**The Design of Electric Ovens.**

A contributor in this issue raises again the question how electric ovens should be heated, and draws upon his own experience to show that even a recent design is capable of improvement. It is a singular thing that a matter apparently so simple should so long remain unsettled. The question is of considerable importance, and efforts should be made by manufacturers to attain some measure of agreement. No great amount of research would be required to furnish the necessary data; ovens heated from the bottom, and ovens with side heating, are available, as well as cooks competent to act as judges of their respective merits. The managers of progressive electricity supply undertakings, who hire out cookers and do not restrict the choice to one particular type, must already have acquired a considerable store of experience with regard to public opinion on the subject—which is really the factor of chief importance. It may be that a cooker designed to meet north-country requirements will differ from one that conforms with southern conditions, but that is a secondary consideration and does not affect the main issue. As our contributor remarks, "we must consult the cooks first and second, and last, and all the time." The electric cooker should be so designed that the popular voice would acclaim it as the ideal cooker, and we are confident that that end could be attained without increase in cost.

**Individual Drive for Wood-working Machines.**

Wood-working machine shops in this country are not invariably well equipped and the initial cost has, in recent years, prevented the installation of modern plant. At shipbuilding yards and general sawmills, we believe, directly trade conditions justify an expenditure on new plant, spindle moulders, tenoning machines, planers, and saws will be installed with built-in motors. In a large proportion of wood-working shops such as cabinet-makers', patternmakers', and joiners' shops, the machines are only occasionally used; they are auxiliary to the benches, and the advantages of the electric drive are obvious. Twenty-five years ago the group drive for small shops became popular. The waste of having a motor sufficiently powerful to drive several machines, when, perhaps, only one was in operation, was small in comparison with that of the gas engine running all day long which it invariably superseded. The group electric drive is efficient up to a point, but it has distinct limitations; where long lengths of timber are being handled, belts are a menace to safety, and apart from the safety factor, they slow down production. High cutting speeds are of the greatest importance, and these are obtained easily with the individual drive; another very important factor is the saving in floor space. Even in shops where the individual drive has been adopted, the motors are usually separate units, but the latest practice—which will increase the popularity of the individual electric drive—is to have built-in motors. The objection to the electric drive for wood-working machines was that it was too positive; timber varies in hardness and grain, and there may be many knots to contend with, and it was thought that a belt by slipping, when the load became too great, prevented damage to the machine and in some cases accidents—but this was largely prejudice. Efficiency and safety in machining operations on timber depend on a high-speed positive drive.

**The Holborn Gas Explosion.**

The extraordinary explosion which wrecked nearly half a mile of roadway in Bloomsbury last week—fortunately without loss of life—appears to have been due to an accumulation of gas in a subway used by the Post Office for telephone and telegraph cables. Whilst unprecedented in extent and violence, it is not the first of its kind, a similar explosion having occurred in the same neighbourhood in 1880. The Home Office has appointed a Commission of Inquiry, which is also to make recommendations with a view to preventing a recurrence of the disaster; pending its report, little can be said regarding the matter, but we may refer to two points which should receive attention. The first is the fact that the gas suppliers had no means of isolating the district; apparently it is considered more dangerous to cut off the supply of gas than to allow it to blow off or burn at breakages in pipes. The second, which applies equally to subways used for electricity supply mains, is that such tunnels should be continuously ventilated.

# A Large Interconnection Scheme.

**Some notes on the interconnection of the power stations in the Pyrenees and of the working of the U.P.E.P.O., a voluntary organisation which effects the necessary load distribution and sales.**

By THEODORE RICH.

IN these days of popularity of the "Grid," it is refreshing to study the working of a voluntary co-operative system that has its basis in economic desirability rather than in yearnings for large-scale contracts. At the Congress of Power Producers and Distributors recently held in Paris, M. Maroger gave a report on the functions and methods of the Union of Electricity Producers of the Eastern Pyrenees, and later, during a visit of a number of members of the same congress to the district in question, operating details and other points were explained.

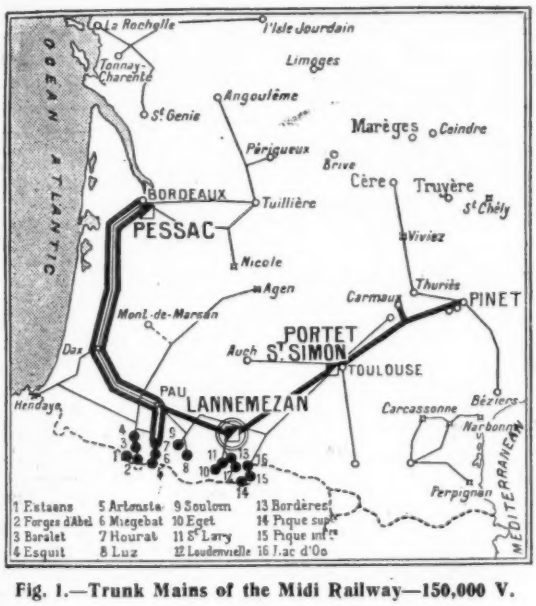



**Fig. 1.—Trunk Mains of the Midi Railway—150,000 V.**

Before the war the Midi Railway made a start on the electrification of some of its important sections with single-phase current from the power stations at Soulom in the west and Fontpédrousse in the east. During the last two years of the war, under the energetic encouragement of the French Ministry of Munitions, great development took place regarding the utilisation of the water power of this region for war purposes. The Cie. d'Electricité Industrielle erected two stations at Luchon to supply a carbide and cyanamide works at Marignac, lower down the valley, with an output of 130 million kWh per year. The Government Powder Department put up stations at Bordères and Londenvielle on the Neste de Louron, each of 10,000-kVA maximum capacity, to supply a somewhat similar works at Lannemezan with an output of 70 million kWh per year. The plant at the Midi Railway power station, then under construction at Eget to provide a single-phase traction supply, was modified to supply 90 million kWh to the same works, and a power station at St. Lary, below Eget, belonging to the Pennarroya Minerals Co., assisted with 70 million kWh.

In 1920 the French Government decided that future long-distance railway electrification should be carried out at 1,500-V d.c. rather than single-phase. It may be noted that among the reasons for this policy were the necessity for interconnection in order to utilise the seasonal water-power available, the knowledge that the traction demand would be only a small proportion of the industrial demands in most areas, and the fact that the operation of certain single-phase sections had given rise to great difficulties on Post Office lines through induction. The Midi Railway, which had already decided to electrify the section from Bordeaux, *via* Dax, to the Spanish Frontier at Irun, and the line from Dax to Toulouse, made arrangements for the alteration of its existing stations to 50 periods, and to build three new stations in the Valley of the Osseau, with a combined installed capacity of 130,000 h.p. and an anticipated supply capacity of 210 million kWh per year. About the same time, the Aspe Valley Power Co. made arrangements to supply power generally over a large area of the Western Pyrenees from four stations with a combined annual output of 100 million kWh. At the time when these schemes were materialising, the financial crisis of 1921 took place, and the problem became acute as to whether a number of industries and enterprises based on water-power could be kept going at all. During

**Fig. 2.—Interior of Hourat Power Station.**

1920-21 the Ministry of Public Works and the Midi Railway decided that the electrical transmission network should be used, not merely to carry the railway load, but also to connect up such of the power producers in the area, including power sellers and electro-chemical works, as might care to profit by such an interconnection. The different power stations thereby ceased to remain isolated in the valleys and were able to find new outlets for their energy, or obtain supplementary re-

**Fig. 3.—Lake Oo, Empty—showing Deposits.**

sources for themselves. This was the first application in France of the idea of a super-network for co-operative transmission of power. The 150,000-V lines created by the Midi Railway are shown in fig. 1. One group of power stations lies in the west, close to Hourat, and a more easterly group lies to the south of Lannemezan. Two parallel lines, each of 50,000-kW capacity, run from Laruns to Bordeaux, with one sub-station on the way at Dax, and a single line, 50,000 kW, branches off at Pau to Lannemezan and goes on to Portet St. Simon, near Toulouse, a total distance of 260 miles, and will shortly be extended to the coal mines at Carmaux and to a distributing system, with some water and steam power connected to it at Pinet, a further distance of 60 miles. Fig. 2 shows the interior of the Hourat power station, which is equipped with five 10,000-h.p. units.

In order to come to a working arrangement with regard to the "dispatching" and sales, a company, the Union des Producteurs d'Electricité des Pyrénées Occidentales, known as the U.P.E.P.O. was formed by six supply companies, including the Midi Railway. The U.P.E.P.O. is itself neither a producer nor transporter of energy; it does not operate power stations or transmission lines. All the stations have not the same annual water-flow curves. The Pyrenean rivers are semi-glacial in flow, resulting in two low-water periods, one in winter, when the precipitation is stored up as snow, and the other during the summer dry season. The flood periods are May, June and July. The winter low water is more pronounced in the central Pyrenees, where the mountains reach 10,000 feet, than in the western area; in the summer, however, the flood season lasts longer in the former. The Pyrenees are relatively well supplied with a number of high-level lakes at altitudes of from 4,600 to 7,200 feet, with utilisable falls of from 2,300 to 2,600 feet. These lakes have not a large water capacity, and can only be filled during the melting of the snow, although autumn rains assist a little.

There are four lake stations: Lac d'Oo, 20,000 kVA; Lac Eget, 26,000 kVA; Lac d'Estaens, 3,000 kVA; Lac Artouste, 20,000 kVA. The last of these is now about completed ready for working; the others are in operation. A view of Lac d'Oo empty is given in fig. 3, which shows the large deposits brought down by the snow and water; the altitude is 4,950 ft. Fig. 4 shows the interior of Lac d'Oo station at Luchon, which contains four 7,000-h.p. Escher Wyss-British Westinghouse units, which work under a head of 2,625 ft. Fig. 5 shows the Lower Pique station at Luchon, which contains four 2,000-kVA Francis-British Westinghouse sets and works under a head of 541 ft.

It may here be pointed out that whereas a water-power station with only river flow has no momentary overload capacity beyond the amount of water available at the head sluices of the pressure pipes, if there is a day's capacity reservoir as at Miègebat, in the Osseau Valley, then a daily peak can be carried, and the water economised in off-peak periods. Where there are storage lakes of capacity running into weeks or months, and naturally the higher the effective head the greater the storage per cu. m. of water, the station then can be designed for a plant capacity equal to that desirable for filling up gaps elsewhere, to give the best all-round result consistent with the storage.

It can be easily understood that once the policy of the utilisation of water power is decided on in regions where there are sectional seasonal variations in flow, especially when coupled with some facilities for comparatively long-period storage, the construction of interconnecting lines and the operation of the power stations on a co-operative basis is a positive advantage; it is outside the scope of controversy, and a very different matter to the interconnecting of steam stations with the elastic output inherent in modern equipment.

In the development of the U.P.E.P.O. scheme, the electro-chemical industry plays a most important part, especially in connection with the production of carbide and cyanamide, as it can be so arranged that surplus, especially unstorable, power can be utilised monthly, weekly, or even by the hour. An important feature is that a number of electro-chemical industries require very little labour per ton of output; further, the summer dry period takes place at a time when labour is in demand for agricultural work.

To get good utilisation, a dispatcher, thanks to the

**Fig. 4.—Lake Oo Station, Interior.**

combination of storage lakes and electro-chemical industries, except at periods of very high water indeed, can at each moment balance the availabilities with the demands, and *vice versa*, and also avoid water losses at night and on Sundays. Further, he can deal very effectively with the peaks. The efficiency of the arrangement is bound up with the contract ("social pact") between the U.P.E.P.O. and its members.

The system is as follows:—Each member agrees to

give a definite amount of power, with margins, according to the capacity of his station, in connection with which the anticipated water supply is a fundamental factor, and also the amount of power he requires for his own business purposes. Once agreed upon, apart from the Midi Railway, which has special arrangements, this holds good for as long as the "Social Pact" lasts.

The normal type of power subscribed for is an all-the-year-round output for 14 hours per day; for example, a 1,000-kW engagement calls for 14,000 kWh to be at

**Fig. 5.—Lower Pique Station, Exterior.**

the disposal of the U.P.E.P.O. each day, under a maximum demand of 1,000 kW. There is, *inter alia*, a type of subscription known as "lake power," from those who have lake storage and agree to put at the disposal of the organisation the equivalent of, say, 1,000 kW continuously, but undertake to supply 3 million kWh when the U.P.E.P.O. wants it, under a minimum momentary demand of 2,000 kW.

Besides the quantities contracted for as above, each member puts his surplus at the disposition of the U.P.E.P.O. These may be the result of ample water, of a diminution in the suppliers' own industrial requirements, or, as in the case of the Midi Railway, of the suppliers not yet being in a position to use themselves all the output they have arranged for; such excess has a variable economic value. The Board of the organisation fixes each year a price at which the electro-chemical subscribers agree to take the excess, although without legal obligation to do so. The price is a function of the market price per equivalent kilogram of nitrogen. When the demand for power exceeds the contracted supply, the surpluses not contracted for are divided up among electro-chemical or other consumers according to certain rules fixed by the Board, which make allowance for the power subscribed, and especially the power supplied in dry weather by electro-chemical undertakings. The price does not hold good if the electro-chemist wants a supply without guarantees by the Board, and, further, a reduction is made if the electro-chemist agrees to take very discontinuous load in the day-time. The dispatcher, knowing the resources of each of the subscribers and the necessities of the *clientèle*, including the subscribers themselves, employs first the contracted-for power, and then deals with surpluses, using up the water in the lakes for the former when other sources fail. The organisation acts as a sales bureau; it sells the power available, handles the contracts, banks the receipts, and divides the proceeds among the subscribers after deduction of its own charges and the sum necessary for the amortisation and remuneration of its own capital. The U.P.E.P.O. uses chiefly the 150,000- and 60,000-V transmission lines of the Midi Railway; the quantity of energy is calculated at its destination, and the selling organisation pays to the Midi Company a transmission charge for each delivery point—Bordeaux, Toulouse, and so on. In general, the energy is sold at 60,000 volts, although some small consumers take it at 10,000 volts; in the latter case much of it is sold from the sub-stations of the Midi Railway under the supervision of the sub-station staff; the sub-stations are about 20 km. apart.

In order to make the best possible use of the water available, and to be in a position to prepare programmes of operation, detailed statistics are prepared, and the daily working of each station is furnished the following day. Further, a combined diagram is prepared showing the total production of all the stations, the amount taken for their own use, the amount supplied from the Midi Co.'s stations, and the amount drawn by that company for traction purposes.

One of the most difficult problems is the maintenance of the frequency. The large lake stations of the Midi Railway and the Lac d'Oo station have great influence in this direction. The frequency tends to fall when unexpected demands are made on the network. At flood time there is a tendency for each station to want to utilise its machines as much as possible, and at low-water periods to curtail its output. To keep the frequency within practical limits, penalties are provided for defaulters in this respect, but it had not been found necessary up to recently to enforce them.

The operating principles are to utilise to the full those stations working directly on streams, and to fall back on the lakes for the balance; to distribute the load in an equitable manner, so that the producers benefit proportionally by the sales; and in flood time to see that no producer supplies too much.

The U.P.E.P.O. began operations in 1924, delivery of energy to Bordeaux began in 1925, and in 1926 eleven stations were in service. The energy available was 489 million kWh, 420 million kWh of which, or 86 per cent., was utilisable through the medium of the organisation. Apart from the flood seasons, the utilisation has reached 95 per cent. The lake reservoirs have a capacity equivalent to 120 million kWh. In 1927 three more stations were added, bringing the energy available up to 610 million kWh per annum. This year the results will be improved by the operation of two new chemical works, and next year the Tunis Phosphate Company will have in operation a phosphate-manure works specially laid out to absorb 20,000 kW of flood-water power. The increase in the absorption by electro-chemical works is at the rate of about 100 million kWh per year.

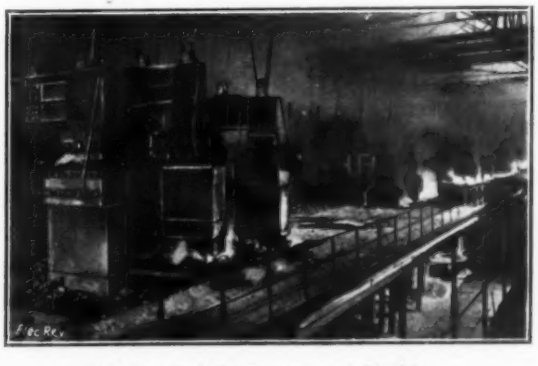


**Fig. 6.—Carbide Furnaces at Marignac.**

Fig. 6 will give some idea of the carbide furnaces at Marignac of the Cie. d'Électricité Industrielle. To enable the storage lakes to be utilised to the fullest extent, it has been decided to link up to a steam power station at the Carmaux collieries to the north-west of Toulouse. The Midi Company has decided to extend its 150,000-V lines to a water-power station on the Tarn at Pinet, which will send current towards the Rhône or Toulouse, according to water flows and demand.

The writer is indebted to the U.P.E.P.O. and to the Compagnie d'Électricité Industrielle for the above information and illustrations.

# Electricity Supply in New Zealand.

**Notes on the electrical system of the Southland Electric Power Board, with particular attention to the economical construction of the overhead lines.**

By CAPTAIN L. B. HUTTON, M.C., B.E., A.M.I.E.E., of the Southland Electric Power Board.

THE Southland Electric Power Board, which operates in the southernmost part of New Zealand, handles all the branches of electrical supply. It generates its own power at its own power-house, transmits to its various sub-stations, and re-distributes to its many consumers over the countryside. It is also prepared to make advances in the way of electrical equipment to approved consumers.

The area under the Southland Board's control is approximately 7,000 square miles, though much of this is, of course, not suitable for settlement. Nevertheless, the area actually served by the Board's distribution lines exceeds 4,500 square miles, and more is coming in every year. The country is essentially agricultural and pastoral, though there is the usual sprinkling of small towns, villages, and industrial areas. The last-named, however, do not predominate. The mainstays of the country are dairying and sheep farming, and the Board's country revenue is derived largely from these two classes. The whole scheme is essentially rural, and it is as a rural scheme that it will be of interest to the English reader.

The power station is situated near Lake Monowai, on the banks of the Waiau River, which is joined to the Lake by the Monowai stream. The Lake outlet was dammed, in order to raise the water level, and a new outlet provided through adjustable gates, through which the water finds its way to the old bed of the stream, down which it flows for four miles. At this point, the river is dammed, and diverted down an artificial canal half a mile long, ending in a concrete forebay. Here again are sluice gates, admitting the water to a steel

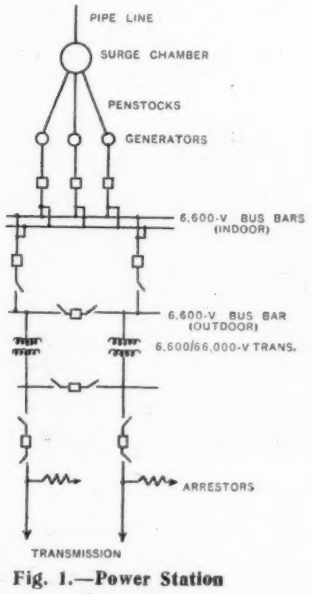



**Fig. 1.—Power Station Lay-out.**

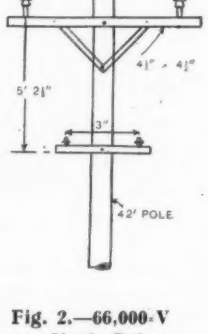



**Fig. 2.—66,000-V Single Pole.**

pipe line, 8 ft. 7 in. in diameter, carried on concrete forms for half a mile. This pipe ends in a surge chamber, whence three penstocks carry the water down a hillside to the power station, giving a head of 150 ft. In the power station are three horizontal turbines, by Boving & Co., Ltd., each of 3,250 h.p., directly coupled to generators of 2,350 kVA, two of these being by the English Electric Co., Ltd., and the third by the British Thomson-Houston Co., Ltd. These three machines take all the available water from the 8 ft. 7 in. pipe, and should extensions be required beyond the 7,000-kVA stage, another pipe line, surge chamber, &c., would have to be built.

Power is generated at 6,600 volts and delivered to a duplicate bus, through the usual oil circuit breakers, the switchgear being of the ironclad type by Messrs. Reyrolle & Co., Ltd. After metering, &c., it is dispatched up the hill by means of underground cables to the outdoor 6,600-volt bus, thence to the 6,600/66,000 volt transformers, and finally through oil circuit breakers to the transmission lines.

Up to this point, apart from the economy of the development, there is nothing of particular interest, or unusual to any degree, and the accompanying single-line diagram, fig. 1, will at once clear up any doubts as to the layout.

With regard to the transmission of power, the salient points to bear in mind are that the voltage is 66,000 V, and that the insulators are of the pin type. The cables are 7/12 copper carried on Australian ironbark poles. 42 ft. in length, set 6 ft. 6 in. in the ground. These poles average 14 in. in the butt diameter, and 10 in. at the top, having an even taper. They are set in the ground without any treatment for preserving the wood, it being considered problematical whether such a hard wood as the ironbark would permit of any penetration. The spans are 400 ft., except where circumstances have decided otherwise. The pole fitting is of the simplest nature, consisting as it does of one large cross-arm 7 ft. long and 4½ in. square, and a shorter arm on the top of the pole, 12 in. long. The top arm is attached to the pole with a galvanised-iron U bolt, and the lower one with a through bolt. This lower one is also braced from each side to the pole. Galvanised steps are fixed on each side alternately, from a height of 12 ft. above ground. A glance at the accompanying sketches, figs. 2, 3, and 4, will give an idea of the simple nature of the structure, fig. 3 being an H-pole, used in places where only one side of a road was available.

Although nothing could be more simple than the structure described, it has proved to be capable of sterling service. The secret, of course, lies in selecting the right materials in the first place; and secondly, in seeing that they are correctly assembled. Four years' unbroken service is the record we can claim from the transmission lines, which is somewhat remarkable when it is pointed out that this is the most southerly transmission line in the world. It has its source in the base of the Southern Alps, traverses a mountain range where the conditions are of the hardest, gets loaded with snow and hoar frost in winter, and is subject to violent gales in spring. Yet its total of 150 miles has remained intact.

The lines travel together for approximately 50 miles, until they reach the Winton sub-station. At this point they separate, one going on another 20 miles to Invercargill, and the other branching 30 miles to Gore. At each of these towns there is a sub-station, where the power is transformed from 66,000 volts to 11,000 volts, through banks of single-phase transformers. The 11,000-volt distribution system thus commences at three points, Invercargill, Winton, and Gore, situated at the angles of a triangle whose sides are approximately 20, 30, and 40 miles in length.

From the outdoor bus-bars, the power is brought into the sub-station building by three-core cable, through

an ironclad panel, and each outgoing feeder is controlled by an oil circuit breaker. From these underground cables take the power over varying distances to the starting poles where the overhead distribution system commences.

Three sizes of pole are in use. First, the 35-ft. pole, with butt diameter not less than 12 in. and top diameter not less than 7 in.—this size is used to carry 11,000-volt lines, and where necessary 400-volt lines as well; secondly, there is the 30-ft. pole, with same diameters as the 35-ft., used for 400-volt and 230-volt roadside work; and lastly, the 25-ft. pole, with butt diameter not less than 9 in., and top diameter not less than 6 in., used for carrying low-pressure lines between the road and the house. The 35-ft. and 30-ft. poles are set 6 ft. in the ground, and 4 chains apart, while the 25-ft. poles are set 4 ft. 6 in. in the ground, and not over 3 chains apart. With these spacings, the necessary clearance is allowed from the ground. Fig. 4 shows the simple construction adopted for an 11,000-volt and a 400-volt circuit on the same pole.

When a sparsely populated rural area is being served electrically, it is essential that construction costs be kept down, and it will be of interest to see just what various types of line cost to erect. It should be pointed out, however, that the labour system in use was of great advantage. After trying day labour, and contract, the Board decided to go in for payment by piece work, and the results were very happy from the point of view of both Board and worker. The following were the prices paid for the various items, and it must be remembered also that the men had to shift camp in their own time, find their own cook, and buy their own food. The Board supplied the plant and tools:—

| | s. | d. |
|---|---|---|
| Digging 6-ft. hole for 35-ft. or 30-ft. pole ... ... ... | 3 | 0 |
| Fitting pole with cross-arms (up to 2 per pole), brace bars, and insulators ... ... ... ... ... ... | 1 | 0 |
| Per cross-arm, when more than 2 per pole ... ... ... | | 6 |
| Propping and ramming (3 men) per pole ... ... ... | 2 | 0 |
| Lifting and setting in hole (2 men), one at 8d. per pole and one at 6d. ... ... ... ... ... ... ... | 1 | 2 |
| Driver of distribution truck (per pole erected) ... ... | | 6 |
| Foreman (per pole erected) ... ... ... ... ... ... | | 10 |
| Extra (for diggers only) when working in either running gravel or rock, per hole ... ... ... ... ... ... | | 6 |
| | 9 | 6 |

So that the maximum labour cost of fitting and erecting a pole could not come to more than 9s. 6d. under the worst conditions, and actually averaged, over one period, 8s. 9d. per pole, and over another period, 9s. 0½d. per pole erected. In addition to the labour

Table A.

| Motor Derrick. | Motor Truck. | Hut Rent. | Petrol. | Supervision. | Horse Derrick. | Fordson Tractor. | Horses. | Chaff. | Total Overhead. | Per Pole. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | s. | d. |
| 142 | 63 | 12 | 81 | 40 | — | — | — | — | 338 | 2 | 0½ |
| — | 85 | 15 | 92 | 37 | 9 | 52 | 25 | 33 | 348 | 1 | 11½ |
| 168 | 70 | 12 | 92 | 30 | — | — | — | — | 372 | 2 | 4 |
| 120 | 50 | — | 59 | 18 | — | — | — | — | 247 | 2 | 8 |
| — | 60 | 9 | 71 | 28 | 6 | 33 | 10 | 14 | 231 | 2 | 1 |
| 42 | 36 | 10 | 54 | 22 | — | 8 | 2 | 3 | 177 | 2 | 8 |
| 472 | 364 | 58 | 449 | 175 | 15 | 93 | 37 | 50 | 1,713 | 2 | 3 |

charge, there were other expenses, which I have classed as "overhead," and which include £5 per week for 1½-ton truck hire, £12 per week for a motor derrick, 15 per cent. on the capital cost of living huts, £3 per week for a Fordson tractor, and actual difference between purchase price of 3 horses, and selling price after work, full value oats and chaff and all petrol, and £20 per month Head Office supervision.

The particulars of costs given in Table A show that for the period under review, the total overhead cost per pole erected was 2s. 3d., bringing the grand total up to 11s. 3½d.

The outstanding point about the whole thing is the piece-work rate, and some doubt may be felt as to whether these rates were satisfactory to the men. They had previously been in receipt of from 14s. to 16s. a

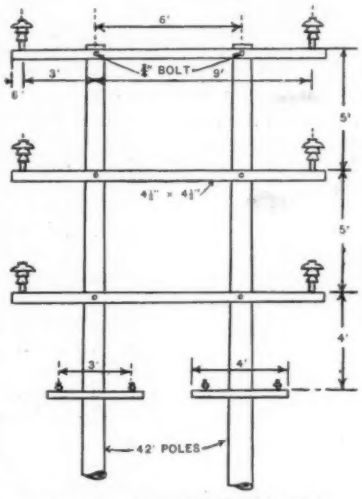



Fig. 3.—66,000-V Double Pole.

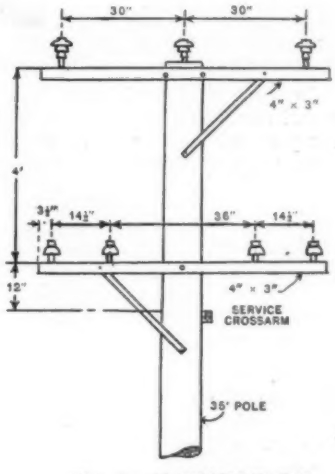



Fig. 4.—11,000/400-V Pole.

day, as a wage, but were persuaded to give the altered conditions a trial. It was difficult to show the driver of the distribution truck, for instance, that he was going to be well off at 6d. per pole erected, because he had nothing to do with its erection, and however hard he worked, he could not alter the situation for the better; but his doubts were set at rest, when the party of 13 averaged 58 poles per day (all 35 ft.) for the first 12 days' work, and he was handed £17 8s. in place of the £9 6s. he would have got under the old *régime*. The hole diggers had the hardest job, but earned sums varying from 21s. per day to 27s. per day. Their record was 87 poles fitted and erected in one day (a long summer day, certainly), and they averaged 52 poles every working day for a period of more than 9 months.

The piece-work principle was then taken a step further, and applied to the erection of the cables, with just as happy results. The prices paid are set out below, and include the carting of all material from the nearest railway station. In this instance, however, piece-workers had to provide their own motor truck, tools, ladders, and petrol, as well as living huts.

Table B.

| | |
|---|---|
| 11,000-volt lines, 3-phase ... ... ... ... | £5 per mile |
| 400-volt lines, 4-wire ... ... ... ... | £6 per mile |
| 230-volt lines, 2-wire ... ... ... ... ... | £4 per mile |
| Guy wires ... ... ... ... ... ... ... | 12/6 each |
| Airbreak switches ... ... ... ... ... ... | £5 each |
| Angle hooks earthed ... ... ... ... ... | 7/6 each |
| Road guards earthed ... ... ... ... ... | 10/- each |
| Pole blocks ... ... ... ... ... ... ... | 5/- each |

Similarly, and simultaneously with the erection of the cables, parties were working on the erection of the service lines connecting the roadside mains to the consumers' houses, and very satisfactory piece-work rates were arranged for this work. In short, where the job is a straight ahead construction one, piece-work would seem to be ahead of all other systems; but it is essential that the worker should receive about half as much again as for day work, and that he should be encouraged to work long hours and increase his output by from 75 per cent. to 100 per cent.

The amount of work done by the individual has a very direct effect on the cost of country reticulation, and it will be of interest to see just how much different types of line averaged. It must be borne in mind that

the port of Bluff is on the extreme south of the Board's area, and that the average distance of haulage on the railways for the whole job is 57 miles. The landed costs of some of the chief items were :—

TABLE C.

| | |
|---|---|
| 35-ft. poles (for 11,000 V) ... ... ... ... | 56/- each |
| 30-ft. poles (for 400 V) ... ... ... ... ... | 46/- each |
| Cross-arm timber (uncut) ... ... ... ... | 42/- per 100 |
| 11,000-V insulators and pins ... ... ... ... | 4/6 each |
| Low-pressure insulators and pins ... ... ... | 1/7 each |
| Ironwork (galvanised) ... ... ... ... ... | Variable |
| Galvanised iron wire (14.5 ohms) ... ... ... | £4 per mile |
| Solid copper wire (Nos. 10, 8 and 7) ... ... | 10d. per lb. |
| Stranded copper wire (Nos. 7/16, 7/14 and 7/13) | 11d. per lb. |

In general 7/.093 and 7/.083 low-pressure wires would have a No. 8 copper neutral, while 7/16, 7 and 8 low-pressure wires would have a No. 10 neutral, though there were, of course, many exceptions to this.

TABLE D.

| Size of wire. | Cost per mile of low pressure. | Cost per mile of high pressure. |
|---|---|---|
| 7/.093 ... | £290 ... | £304 |
| 7/.083 ... | £272 ... | £286 |
| 7. ... | £210 ... | £226 |
| 8. ... | £194 ... | £216 |
| 8 galv. iron ... | Not used ... | £176 |

The outstanding point about the foregoing table is that one mile of 11,000-volt line could be erected, using galvanised iron, for a total cost of £176, which cannot be considered excessive.

The cost of transformers must be watched carefully, and the Southland Board has always made a point of "loading" a transformer with all the overhead it can carry, before putting it in service. One large batch of transformers landed here was costed very carefully, and the following table gives their economic history up to the time they were put in service. Under the column "net" is a figure which is the ex ship cost. The "gross" column is the cost when primage, clearance, and freight to test room is added; while the "erected" cost shows the transformer up in the air, either on pole or platform, after having been unpacked, dried, tested, filled with oil, and freighted to its place; and it also includes the insulators necessary for high-pressure and low-pressure leads and three 11,000-volt fuses.

TABLE E.

| Size in kVA, 11,000 volts. | Net cost. | Gross cost. | Total cost erected. |
|---|---|---|---|
| 3 ... | £22 ... | £24 ... | £35 |
| 5 ... | £39 ... | £42 ... | £60 |
| 10 ... | £50 ... | £55 ... | £75 |
| 15 ... | £63 ... | £69 ... | £82 |
| 20 ... | £75 ... | £82 ... | £106 |
| 30 ... | £99 ... | £110 ... | £135 |

Having determined the cost of the line itself, whether 11,000-volt, 400-volt, or 230-volt, and also the cost of different-sized transformers mounted ready for service, it becomes necessary to determine the cost of a 400-volt line, and a 230-volt line, when erected on the same poles as the 11,000-volt line. This is necessary in order to determine whether to increase the size of any given transformer (not always necessary, perhaps), and erect copper low pressure; or to do away with low pressure altogether, and erect a separate transformer near the new job. The following table, built up on our construction costs, is designed to indicate which method of construction is the more desirable, purely from a line cost *versus* transformer cost point of view. It must not be assumed that such a table is sufficient to settle a point. Other considerations must be borne in mind, but the table is a valuable first indication :—

TABLE F.

| Where low pressure wires are: | 20 | Chains of three-phase service: 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|
| — | £ | £ | £ | £ | £ | £ | £ |
| 7/.093 | 47.2 | 70.8 | 94.4 | 118.0 | 141.6 | 165.2 | 188.8 |
| 7/.083 | 43 0 | 64.5 | 86 0 | 107.5 | 129.0 | 150.5 | 172.0 |
| No. 7 | 27.5 | 41.3 | 55.0 | 68.8 | 82.5 | 96.3 | 110.0 |
| No 8 | 23.5 | 35.8 | 47.0 | 59.3 | 70.5 | 82.8 | 94.0 |

As before, 7/.093 and 7/.083 have a No. 8 neutral, and the others a No. 10 neutral.

The interpretation of this table is that where a 5-kVA three-phase transformer will carry the load, this transformer is cheaper than low pressure for all distances greater than

| | | | |
|---|---|---|---|
| 26 | chains | where the wire is | 7/.093 |
| 28 | ,, | ,, | 7/.083 |
| 46 | ,, | ,, | No. 7 |
| 50 | ,, | ,, | No. 8. |

Similarly, comparisons can be made for other sizes of transformers, and for 230-volt lines, as well as 400-volt lines.

And now as to the class of consumer, and the nature of the load. There are more than 8,000 consumers, who may be divided into, first, country and town, and then into industrial, dairying, electric range, and lighting. The boroughs of Invercargill and Bluff are supplied in bulk and count as one consumer each. This class of business cannot be considered a very satisfactory one from the generating point of view, in that the boroughs demand a low rate in order that they may retail the electricity at a profit. If the Board were selling direct to the town consumer, the business would at once become a very good one, on account of the excellent return from grouped domestic lighting.

The industrial connection is not a very large one—not that the Board cannot compete, but simply because industries have not been attracted to this part of the country. In the majority of cases, the Board is able to secure industrial load on a 1½d. per unit basis; and although this may be considered high at first glance, it must be remembered that a job such as a flaxmill, is generally situated off the trodden path, where a constant supply of fuel becomes a difficulty. One great advantage of the electric drive lies in the fact that whereas a steam engine requires a certificated driver, an electric motor may be operated by anyone. As steam-engine drivers work under an arbitration court award, and their prestige generally prohibits them from assisting at anything but driving the engine, they are a distinct nuisance about the place. As an alternative to the unit rate, the consumer may elect to purchase on the kVA and unit basis, in which case the charge is £12 per annum for the first 100 kVA, £10 for the next 100 kVA and 10s. per kVA per annum afterwards, plus a unit rate depending on the circumstances, but seldom exceeding one half-penny. It is, however, only the larger industrial concerns which can buy on the kVA basis, examples of these being coal mines and freezing works employing 2 or more shifts. A final industrial group consists of those who have an alternative source of power, and in negotiating with them it becomes a matter of comparison with the cost of the other source of supply. In addition to this, also, there is always the point that while power cannot be sold elsewhere, it may just as well be released cheaply to assist a local industry, rather than not used at all. A New Zealand Power Board can take this attitude because it is essentially not a profit-making concern; but when the power can be disposed of elsewhere at an increased rate, the industry in question must be prepared to pay more, or go elsewhere.

The method of charging for domestic consumers is not quite as simple as it might be, and yet not in any way complicated. The man who has an ordinary light, heat, and power installation is charged :—

| | | |
|---|---|---|
| For the first 21 units per month | ... ... | 7d. per unit |
| For the next 21 | ,, ... ... | 4d. ,, |
| For the next 42 | ,, ... ... | 2½d. ,, |
| For all over 84 | ,, ... ... | 1½d. ,, |

Thus, the man with lights only never gets below 7d. per unit; a lighting and large radiator connection is required to come down to 4d.; lights, heating, and, say, a milking motor might bring a few of the units down to 2½d., while quite a large installation of lights, heating, and milking or general purposes motors must be in use before the 1½d. rate is reached. In other words, a consumer must be using more than £16 worth of elec

tricity before he gets on to the 1½d. rate for ordinary purposes.

Special purposes are cooking and water-heating, for which the Board quotes special rates of 1d. per unit and ½d. per unit, respectively, provided the water-heater is on a throw-over switch with the range.

Annual minimum guarantees are required in respect of the various appliances, the list being detailed below:—

| | |
|---|---|
| For lighting and heating ... ... ... | £4 a year |
| For milking motor up to 3 h.p. ... ... | £10 ,, |
| For electric range up to 6,000 watts ... | £6 ,, |
| For electric range up to 7,000 watts ... | £8 ,, |
| For electric range up to 8,000 watts ... | £10 ,, |
| Industrial motor capacity charge, up to 50 h.p. ... ... ... ... ... ... | 5/- per horse power per month |

The usual size for a milking-machine motor is 2 h.p., which is capable of working a 6-cow plant. The milking motor is regarded as a good revenue earner, because it carries with it the £10 minimum, and with the average herd of 30-40 cows, will use about £20 worth of electricity in the 8 months' milking season. Being a three-phase load, its current demand is small, and three such motors can be worked off a 5-kVA transformer, together with lights, &c. Road and service line mains need not be larger than No. 10 or No. 8 copper, depending on the length of run; and the Board serves 2-h.p. motors quite satisfactorily at the end of 1 mile of 3-phase No. 8 copper.

The Board has on its lines more than one thousand electric ranges, and is supplying them all satisfactorily. It cannot, however, be admitted that cooking at 1d. per unit is an ideal return for an authority supplying a scattered rural area, but in this case, there were reasons. First, there are not only large coalfields handy, but there are also huge deposits of a lignite which sells at 12s. a ton, and which has been largely used throughout the district. We had, therefore, to compete with other sources of heat, and fixed on 1d. per unit as the most a family could pay, who use in the region of 12 units per day all the year round. As the country is about evenly divided between dairying and wool growing, there were a large number of houses with no use for large motors, ¼ h.p. or ½ h.p. being enough for shearing machines. If revenue was to come from them, it had to come from cooking; and we accordingly set out to get the cooking load.

Hand-in-hand with cooking at 1d. per unit, goes water-heating at ½d. per unit, provided it is on a change-over switch with the range. This limits, to a great extent, the amount of heat that can be put into the water, and most of the heat is imparted during the night hours. We limit the size of the heating element to 1,500 watts, recommend a container not exceeding 20 gallons capacity, and insist on efficient insulation with suitable lagging. As an alternative to the range, a water-heater may be on a change-over switch with a milking motor in a cow-byre, the hot water being used to wash the pails and churns, &c.

Supply to ranges and water-heaters in the country is a matter for special study, especially if the range is of the large (or 8,000-watt) size. We have adopted the system of making a three-phase supply available, one phase going to the hotplates and one phase to the oven. The third phase supplies the house lights and heating points. The water-heater, if there is one, is on the same phase as the oven, but, of course, cannot be used with it. A 5-kVA transformer will serve an installation of an 8,000-W range and water-heater, because although it is possible to put a load of 4 kW on the hotplate phase alone, this is scarcely ever done. It would mean that all four hotplates were on full heat at the same time—a most unusual proceeding. Due attention must be given to the length of low-pressure mains, the size of the wire, and the voltage drop; and in this connection, supply authorities in this country have to maintain the voltage within 5 per cent. of 230 V at the consumers' terminals—not by any means an easy thing to do.

What is the best source of revenue, in order of preference?

1. Lighting and heating in small towns, because it is nearly all at a high rate, consumers are close together, transformer capacity and road mains can be small, and the jobs are easy to service.

2. Dairying districts, where the average return per unit lies generally somewhere between 2d. and 5d., and seldom falls as low as 1½d.

3. Industrial jobs which will take a block of power—50 to 100 h.p.—and are prepared to pay 1½d. per unit for it. Such a connection may be worth up to £1,000 per annum.

4. Cooking consumers, who, together with their lighting units, will average a little more than 1d. per unit, but less than 1½d.

5. Bulk buyers on the kVA basis, who generally get below 1d. per unit, and may be as low as ¾d. per unit.

The danger in rural electrification lies in this: that the cost of service is high compared with town reticulation; that the consumer is conservative, and will take things slowly; and that he is difficult to force. His consumption per head will go up, but it will go up slowly, having started low. The amount of money that can be extracted from him in return for a supply of electricity is relatively small. He has not the opportunity to spend, as has his town brother, and he has become sparing in consequence. To meet these difficulties, rates must not be set too low to commence with. People will always demand lower rates—and it may be possible to lower them; but it is scarcely possible to raise rates; and a very careful analysis must be made beforehand in order to determine whether the *minimum* annual revenue will meet the interest, sinking fund, depreciation reserve fund, renewal fund, and the cost of service.

# Vouchers for Consumers.

## A mode of developing the use of small domestic electrical appliances.

By C. O. BRETTELLE, M.I.E.E.

THE high consumption of electricity among residential consumers in the U.S.A. has hitherto owed little to the use of the heavier cooking and heating apparatus. It is rather due to a very widely extended use of appliances which require very little energy individually, but which provide in the aggregate a very profitable load. Such a load can easily be dealt with on existing distributors and house services, and is very often connected to the lighting installation.

A method of building up such a load has been suggested* which is based on the issue by supply authorities to residential consumers of vouchers bearing values proportionate to their annual consumption. The consumers would be entitled to exchange these vouchers or give them in part payment for any current-consuming apparatus (except lamps) at the showrooms of the undertaking, or of any co-operating contractor. The additional apparatus thus connected would increase the profits and, consequently, in the following years vouchers of a cumulatively higher value could be given away.

To put this proposal into concrete form, the case may be taken of an undertaking having 10,000 residential consumers yielding a revenue of £40,000 at 6d. per unit. There is a surplus of £4,000 (after meeting all charges) which could be devoted to a reduction in tariff. As, however, capital expenditure on apparatus is a more serious obstacle to the extended use of electricity than high rates, the supply authority decides to use the surplus in the manner referred to above.

The average consumer of 160 units per annum would, with his receipt for the last quarter's account (making

* *Journal* of I.E.E., Vol. 62, page 117.

up £4 for the year), receive a voucher for 10s. This 10s. is made up of (4,000/40,000) × £4, plus, say, 2s. The additional allowance of 2s. is made on the assumption that only 80 per cent. of the consumers would take advantage of the opportunity to acquire apparatus on these terms. Assuming the average consumption of new apparatus connected to the lighting circuits under this scheme to be 40 units per 10s. of capital outlay, the consumption at lighting rates would be increased by 25 per cent., so that in the second year the value of the voucher to the average consumer would be 12s. 6d., and at the end of the seventh year £1 18s. 0d. With a two-part tariff in force, the same considerations would apply, since the value of the voucher is dependent upon gross revenue which includes the same surplus, whichever form of tariff be adopted, although on a greater consumption.

The advantages of the scheme may be summarised as follows:—

(1) Securing a tangible article without payment would appeal more to consumers as a whole than a small reduction in rate for energy.

(2) Consumers would be brought to the showrooms, where they would be shown other useful electrical apparatus and have hiring terms explained to them.

(3) If a consumer desired apparatus more expensive than the face value of his voucher, the latter would be accepted in part payment; this would often influence him to choose an article of a better class than he would otherwise have done.

(4) Consumers who had not hitherto adopted a two-part tariff would more readily appreciate its advantages, if the only alternative were to pay for their increasing load at standard lighting rates.

(5) The value of the annual vouchers could be varied to suit conditions to be met by the supply authority, such as a temporary increase in cost of fuel. This might obviate the necessity for a temporary increase in the charge for energy supplied to consumers.

# Bottom or Side Heat?

**The makers of electric cookers should study the convenience of the user as the fundamental consideration in design.**

By A STATION ENGINEER.

ONE of the problems of electric cookers is the question whether the heating elements should be at the bottom or sides. So far as I have been able to find out by experience, cooks prefer bottom heat and designers prefer side heat. Some years ago I tried an oven with side heat; it cooked quite nicely so long as the food was placed well up in the oven, but it would not cook at the bottom. The maker recommended that the food should be kept well up, but this had the obvious defect that about one-third of the oven was useless. When a substantial hot-plate was fitted at the bottom, the oven worked very well indeed, and although it is of an ancient pattern it is still a favourite in the kitchen. Later I tried out some well-known side-heat ovens, but the results were not very good, although the makers said that the ovens were ideal. One large oven was taken by an expert cook, who said that it was tricky to work. Some bottom heat was added, and the oven then became quite satisfactory. Later some of the earlier side-heat ovens required overhauling, and the makers recommended that they should be scrapped, although they were not by any means old.

About a month ago I obtained one of the latest up-to-date ovens of a celebrated maker, with side heat and a certain amount of bottom heat. This was put into the kitchen instead of the above-named ancient oven, and the results were disappointing. Bread, for instance, was scorched in the top of the oven and undercooked at the bottom, and altogether the results were unsatisfactory. The elements were altered by the makers to give higher bottom heat and less side heat, and the cooking qualities were improved.

It is all very difficult to follow. Why do some makers stick to side heat while others specialise on bottom heat? A friend who has tried both types informs me that cooks prefer bottom heat because they can use the ovens without special instruction—a very good reason. Scientifically, bottom heat is better than side heat, because if the bottom of an oven is hot, the top will look after itself. On the other hand, it is quite possible to have the top of an oven very hot, while the bottom part is relatively cold. Air is a bad radiator: the air at the top of a room may be stifling while the floor is cold and draughty, and the air at the top of an oven may be much hotter than at the bottom. If a cold fruit or meat pie, containing a large percentage of water, be placed at the bottom of an oven, it will take much more heat than lighter material at the top. I have found that bread baked in a side-heated oven was burnt at the top of the oven, while at the bottom it was not cooked enough. Probably the difference between north and south country cooking has something to do with it. South-country people buy their bread and do not have the heavy cooking that is prevalent in the north, and it is possible that an oven which works well in the south may not be so good in the north. Makers tell me that people can succeed better after careful teaching by an expert demonstrator; but why should such teaching be required by cooks who have been accustomed to coal-fired ovens? One must not attach too much value to absence of complaints. Sometimes one finds that complaints do not come, just because people are using the oven merely for fancy work and are doing all their heavy cooking in the coal-fired oven. In this matter we must consult the cooks first and second, and last, and all the time. If the cooks are not content, it is no good having splendid reports from makers' experts. My own conclusion is that there should be bottom heat; some side heat also is advantageous, but the bottom heat must not be skimped. If the bottom of the oven is hot, the top is also hot: the heat rises, but it does not descend.

Certain other points require attention. Many ovens are packed with light packing of a woolly nature. This becomes solidified after a time through the effect of water vapour. Blocks of lagging are now being made which are astonishingly good heat insulators and which appear likely to keep their heat-insulating powers. These deserve careful attention from makers. Another point, and an important one: some well-known makers send out heaters of a type which increase considerably in resistance in the course of time. The wires have to stand up to bad conditions, namely, great heat, in the presence of steam and other vapours, and they are liable to oxidisation. When this happens the oven ceases to heat up properly. Resistances should not be run too hot, and should be made of material which is seasoned and not liable to surface change. Makers also should avoid skimping the heat capacity of the ovens. It may sound economical to say that an oven runs with 10 per cent. less watts than a competitor's oven, but in practice the lightly loaded oven has to be run at full load for so long a period that it actually uses more units than the oven with a higher loading. An under-heated oven is a nuisance and a trial to patience, while an oven with generous heating may be kept down to the right temperature by switching on to the lower heats.

# Compensation Claims.

## An examination of the position of employés who suffer loss of status or employment in consequence of the operation of the Electricity (Supply) Acts, 1919-1926.

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E.

(*Concluded from page 1085*).

### Who Pays the Compensation?

The liability for compensation will be upon the undertaker to whom the transfer has been made if the displacement is in consequence of the transfer of one undertaking to another. As a case in point one could quote the formation of the Ayrshire Electricity Board. The undertaking of the Ayr Corporation was transferred with the consent of the Commissioners to the Ayrshire Board, with the result that certain employés were displaced. The compensation to those employés was payable by the Ayrshire Board. Where the displacement occurs as a result of the closing down of a generating station consequent upon the taking of a bulk supply, then the undertaker whose generating station is closed down will be liable to pay the compensation. It has already been stated that if an undertaker can show to the satisfaction of the referee that equivalent employment was available at the date of the transfer, &c., it may escape liability. The point arises as to the precise meaning of the words "was available." If an officer or servant secures a position with another undertaking through his own efforts is he deprived of the right to claim compensation? or will the referee take into account the fact that he has obtained another position when assessing the amount of compensation? The language of the section appears to be specific enough. The undertaker against whom the claim is made must show that equivalent employment was available *at the date when the transfer, &c., was effected.* If the employment was not available at that date, then the title to compensation accrues, and, strictly speaking, it ought not to be affected by the fact that the officer in question secures another position subsequently. In the case of the Ayrshire Board, the undertaker was unable to show that equivalent employment was available for certain of its employés when a transfer was effected, and though a reference was made during the hearing to the fact that one of the employés had subsequently obtained other employment, it does not appear to have influenced the referee in deciding the amount. This is obviously only fair. It is admitted that if an undertaker is instrumental in securing another similar post for an employé by the allotted date, then there is some justification for that fact being taken into account when the claim is being dealt with. If, however, the undertaker is unable to do this and dispenses with an employé who then through his own efforts secures another post, this in itself ought not to constitute a valid reason why the undertaking should be relieved of its obligations. For example, an official after being dispensed with might accept an appointment abroad rather than be out of a post and thus be involved in considerable expense, to say nothing of the inconvenience and insecurity. It would be unfair if his claim for compensation was prejudiced as compared with another official who had made no effort whatever to secure another position. No doubt each case will have to be decided on its merits, and the referee will exercise his discretion in the matter.

### How is the Compensation Assessed?

As far as a servant is concerned, the amount of compensation payable is solely at the discretion of the referee, but in the case of an officer employed on an annual salary, it must be based on, but not exceed, the amount which would have been payable to a person on abolition of office under the Acts and rules relating to his Majesty's Civil Service in force at the date of the passing of the Local Government Act, 1888. These rules provide for the payment of a special annual allowance which shall not exceed two-thirds of the salary and emoluments of the office. In calculating these allowances it is the practice of the Treasury to award as many sixtieths of the officer's emoluments as he has served complete years, with the special addition on account of abolition of office not exceeding the following scale:—

| Actual service. | Addition. |
|---|---|
| 20 years or upwards ... ... ... | 10/60 |
| 15 years and less than 20 ... ... | 7/60 |
| 10 years and less than 15 ... ... | 5/60 |
| 5 years and less than 10 ... ... | 3/60 |
| Under 5 years ... ... ... ... | 1/60 |

In computing the period of service, the years of service under any other authorised undertakers is to be taken into account, as well as the period of service with the undertaker with whom the officer is engaged at the time of displacement, also years of temporary absence whilst serving with the Forces or in any other employment of national importance during the war.

There was an interesting point argued at great length in the Morley arbitration, namely, whether compensation was by way of superannuation or was merely to provide for a break in employment which resulted from a scheme or arrangement under the Act. It was contended from one side that the whole object of the compensation sections was to afford to the dismissed employé the opportunity of obtaining equally good employment elsewhere, and in support of this it was argued that the period during which compensation could be claimed was limited in the Act to five years. The effect of the Act was that an employé was secured for five years, and therefore all that he was entitled to by way of compensation was a figure based on that period. In other words, the object of the compensation provisions was not to put upon authorised undertakers an obligation to superannuate their employés, but to pay them a sum which would afford them reasonable assistance until they were able to obtain equally satisfactory employment elsewhere. No opinion was expressed by the referee on this point, and it is not easy to draw any conclusions from the procedure. It does appear as if a five years' basis has been taken in some cases, but longer periods in others. It is obvious that a definite term such as five years cannot be applied without regard to all the surrounding circumstances. In the case of men who have spent many years in the industry and whose prospects of securing other analogous positions are slight, compensation ought to be on a generous basis approximating to a superannuation basis, whereas in the case of young men who are more capable of securing other employment, the five-yearly basis would not seem to be unfair. The Treasury regulations do not provide for a term of years, so that presumably the referee can exercise his discretion so long as the compensation does not exceed the amounts laid down in those regulations. It should be noted that the Treasury regulations speak of an annual payment, but it has been the practice in all the cases which have been decided for the referee to award a lump sum. This has usually been done with the consent of the parties. There is nothing under the

Act to provide that compensation shall be paid as a lump sum or as an annual payment, so that presumably again the referee has discretion. It should also be noted that the Treasury regulations only apply to an officer, and not a servant; in regard to the latter the referee has absolute discretion.

**Under the 1926 Act.**

The fourth Schedule of the 1926 Act is based on Section 16 of the 1919 Act as amended by Section 21 of the 1922 Act, but there are several important adaptations which must be noted. In the first place the date, May 8th, 1919, is not included so that a claimant under the 1926 Act will not have to prove that he was employed by an authorised undertaker before that date. Incidentally, under the Bill promoted by Mr. Kelly, which has just been passed by Parliament, the date will be deleted from the 1919 Act. Thus, it will make no difference to a claimant when he entered the supply industry, whether before 1919 or afterwards. Under the 1926 Act the claimant has to prove that under or in consequence of that Act a generating station has been closed or acquired, or restrictions on the working or use thereof imposed or a main transmission line or any part thereof has been acquired and that as a result he has suffered loss of employment, diminution of salary or wages, &c., or has relinquished his employment in consequence of being required to perform duties which were not analogous or has been placed in a worse position. It should be noted that these conditions are very wide, and cover the case of dismissal or reduction in salary not only in the event of a station being closed down permanently or temporarily but also as a result of restrictions being imposed on the working or use of the station. If an employé in a station is dispensed with on account of the number of running shifts being reduced, or the periods during which the station is run severely curtailed, he will be entitled to compensation. Or if as a result of restrictions imposed under the Act his responsibilities are reduced and his salary is reduced proportionately, he will be entitled to claim compensation for the reduction. An interesting point is likely to arise under this head, *viz.*, whether if the total capacity of the steam plant in a station is reduced as a result of the operations of the Act and the classification of the station under the Schedule of Salaries is reduced, the members of the technical staff will be entitled to claim compensation for the difference. On the face of it there does not seem to be any reason why they should not.

The compensation is to be payable, in the case of a generating station being closed or having restrictions imposed upon it, by the authorised undertaker to whom the station belonged or belongs. In the case of a station or a transmission line being acquired, it will be payable by the acquiring authority. The onus of proving that equivalent employment was available at the date of the closing or restrictions will be borne by the undertaker upon whom the obligation to pay compensation rests. No difficulties are likely to arise on the question whether the closing or restrictions are under or in consequence of the Act, as it is provided that this shall be determined by the Electricity Commissioners.

With regard to the amount of compensation payable, it should be noted that the Treasury regulations still apply, with this difference, that they are only to form the basis for determining compensation where loss or relinquishment of employment is involved.

In conclusion, it may be remarked that both the 1919 and the 1926 Acts enable the Minister of Labour to make rules as to the procedure before the referee, and he may by those rules provide for limiting the amount of costs and for fixing the fees to be paid to the referee, &c. So far no such rules have been framed, and it has been left to the referee to decide how the costs should be awarded. The decisions do not appear to have been very consistent. In the Morley case the referee ordered each party to pay its own costs of, and incidental to, the hearing and the award. In the Llandudno case the undertaker had to bear the costs of both parties, and similarly in the Hampstead case. In the Mansfield arbitration the award provided that a definite sum of £12 12s. should be paid by the Corporation to the claimant as costs of, and incidental to, the reference. The latter sum was obviously a small amount, and raised the general question whether if this is to be taken as a precedent it is sufficient. In some cases it is necessary to employ counsel when an important legal question is involved, and the small sum awarded in the Mansfield case is obviously inadequate to meet such a contingency.

One may express the hope that the Minister of Labour will take advantage of the powers which reside in him and furnish rules which will serve as a guide in regard to costs, &c., for the future.

# American Capital in British Industry.

## A Consideration of Some Possible Effects.

By LESLEY F. RATCLIFFE.

THE prosperity of America during the last few years has enabled many of the middle class by speculation and investment to enter the realms of finance. Few better opportunities present themselves to the small investor than those offered by the large finance and trust corporations, excellent examples of which appear in this country. These companies have facilities for obtaining information which enables them to place their resources with a measure of security and advantage denied to the small investor.

Experience in the past has shown that protection against national disasters, trade depression, and other disturbing influences can only be obtained by dividing up the total capital and investing it in widely differing industries in the various countries of the world.

This principle is based upon the known fact that general world trade depression is happily of very rare occurrence, and in any case cannot be guarded against, whereas a temporary depression in one industry or country (due to local conditions) invariably results in a reactionary advantage in some allied industry or country. American banks and finance corporations have therefore been centring their attention upon countries of the world which show signs of industrial enterprise that present a reasonable opportunity for the investment of capital.

Such an opportunity is the development of the electrical supply and manufacturing industry of this country which is just entering on an intensive scheme of development under the operation of the Electricity Acts. Everything points to a period of activity and prosperity in this industry at present and for several years to come, which most certainly offers a good opportunity for the investment of capital. It is not

surprising to learn, therefore, that American capital is finding its way into the electrical supply and manufacturing industry of this country.

The statement made by the lay Press recently that the financial control of some of the most important sections of the industry lies in the hands of America may be an exaggeration, but the conditions as they exist certainly have a tendency in that direction.

The fact that there is this tendency for American interests to acquire the financial control of a large and important industry, such as the electrical industry of this country, upon which at least 250,000 men depend for their living, cannot fail to influence both the industry and the country to some extent.

These notes are prepared with a view to illustrating the economic and political effects which such conditions are likely to create.

While it would be possible for this financial control to be obtained unconsciously, it is very unlikely, and has therefore been ignored.

### Economic Effects.

The introduction of foreign capital into a country has very little economic significance until it reaches a value where it tends to become a controlling influence in some particular industry. Its influence, then, though difficult to define, becomes very real and of importance.

All industries have to meet two obligations, they have to provide a suitable return to their shareholders for the capital invested in them and a reasonable return to their employés for the service rendered to them. The interests of these two parties should, in theory, be absolutely in common, but in practice this condition does not always materialise. The prosperity of the industry expresses itself by a larger return to the shareholder and the employment of yet more labour.

Times of depression are characterised by a fall in the return to the shareholder and a reduction in the number of people employed. The fact that the shareholder participates directly in the prosperity of the industry and the employé does not, has always formed a bone of contention to those interested in the obligations of industry. It, however, accentuates the fact that the prosperity of industry is a thing of national importance.

Times occur, as we know by bitter experience, when the failure to agree between the two sections of industry leads to a dispute which threatens ruin to both. Unfortunately these differences rarely occur during times of prosperity, but they generally coincide with periods of trade depression, when no surplus is available to allow any drastic adjustments to be made to settle the dispute.

This country owes no mean part of its stability to the characteristics of the race to get together during times of trouble. It has been this spirit that has come to the rescue in every big industrial dispute, where both sides have made sacrifices for the good of the industry and the country.

Certain markets of the world of which we hope eventually to obtain our share, are at present entirely in the hands of our American competitors. In fact, the increased facilities for production of which the industry is capable, make our entrance into these markets a matter of vital importance.

The prosperity of the electrical industry of this country upon which thousands depend for their employment is a matter of national importance. Under the happiest combination of British capital and skill it is no easy matter to reach and maintain prosperity in these days of enterprise, so that competition and the introduction of foreign capital must eventually introduce a conflicting influence which will eventually affect the industry, its employés, and the country, adversely.

### Political Effects.

It is impossible to generalise upon the political effects due to the intrusion of foreign capital into the electrical industry. But it is of interest to note that it has a very considerable effect upon the two countries concerned. In other words, it acts as an additional factor to further complicate what is already a complicated business.

In giving a common interest to the citizens of both countries it must help to bind the countries together during times of prosperity, but in times of industrial depression or dispute it may be instrumental in causing considerable damage. Nationally, we shall quite rightly be biased in favour of our own countrymen; in the same way, we must expect the government of the shareholders to sympathise with them and to exert its authority on their behalf in the safeguarding of their capital.

The success of the combination, therefore, depends upon its ability to withstand the stress that opposing interests and sympathies will sooner or later impose.

In conclusion, it seems regrettable that there should be any hint of foreign capital entering the electrical industry of this country when it presents such unique opportunities for the business enterprise and technical skill of the country to create a great and victorious combination.

# Legal.

### Theft of Electricity.

ON December 17th, the Exeter magistrates heard summonses against Percival T. Scott, an Exeter electrical engineer and contractor, charging him with "maliciously and fraudulently causing to be diverted and consuming electricity, the property of the Exeter Corporation." It was stated for the prosecution that during a "shopping week" the defendant had connected a special lighting installation to a heating and cooking circuit, thereby wrongfully obtaining energy at a reduced rate. The defendant said that he had intended to notify the Electricity Department of what he had done, but before he could do so the mains superintendent visited the premises, noticed the installation, and reported the matter.

The wording of the summonses was contested but the magistrates decided to convict on one of them and fined the defendant £5, dismissing the other charges. Our local correspondent reports that the defendant's solicitor made the curious statement that "it was no crime to steal electricity. It was the same as air, light, or water, or any other of the gifts that God gave us and which are common to us all." He also said: "Every lawyer in the country will agree that to make it an offence to steal electricity a new statute will have to be brought into operation."

### Unlicensed Wireless Transmitter.

*The Times* reports that at the Bolton Borough Police Court on December 17th, Cecil Grundy, motor engineer, of Rishton Lane, Bolton, was fined £5, and ordered to pay £5 5s. costs and to suffer the confiscation of his apparatus, for using a wireless transmitting set without being licensed to do so. Mr. F. Elliott, prosecuting for the Postmaster-General, said this offence was a serious one. The transmitting set had been used for two years, and it had taken all that time and much expense to detect the user of the call sign "ORS." There were, he said, more unauthorised transmitting stations in South Lancashire than in all the rest of England put together.

### Irish Telephone (New System) Co., Ltd., v. National Union of Railwaymen.

IN the Dublin Circuit Court, before Judge Shannon, last week, the Irish Telephone (New System) Co., Ltd., sued the National Union of Railwaymen for £19, alleged to be due for telephone service supplied by the plaintiff company to the officers of the defendants in Dublin, from the year 1923 to the date on which the service was terminated by the defendants.

Mr. C. D. WATERS, Irish secretary to the defendants, gave evidence to show that the service was unsatisfactory from time to time, and that he had made frequent complaints to the company's manager. Finally, in October, 1927, the defendants cancelled the contract, owing to the alleged breach of it by the plaintiffs in neglecting to give efficient service.

Judge SHANNON said that it appeared to him that the true construction of the agreement was that if the installation was not kept in proper working order, the defendants' remedy was to sue the plaintiffs for breach of contract, and that the defendants had no right to cancel the contract as they had done. He gave a decree to the plaintiff company for £10, subject to any rights the defendants might have to proceed for alleged breach of contract on the part of the plaintiffs.

### Lektophone Corporation v. S. G. Brown, Ltd.

THE hearing of this action was resumed on December 19th. The plaintiffs alleged that the defendants had infringed a patent by selling a "Mascot" loud speaker at the Radio Exhibition, 1927.

Mr. W. H. BALLANTYNE, for the defence, gave evidence regarding cone loud speakers with free edges, constructed according to specifications prior to that of Hopkins, which he said gave very good results. He produced the patent index for 1909 to 1915, which, he said, showed that the Hopkins patent was indexed under "gramophones, phonographs, and the like sound producing and reproducing instruments." He had made a number of experiments with the "Mascot" cone out of the box with its edge free. While it was reproducing music he had maltreated it, but it made no difference to its excellent reproduction.

In cross-examination by Mr. TREVOR WATSON, he said he remembered the Hopkins patent in 1927 because it was then that the advertising campaign with regard to licences began. He knew that the plaintiffs had a working arrangement with Standard Telephones & Cables, Ltd. Asked whether he considered that a test depending purely upon the ear would give a reliable scientific comparison between two loud speakers, Mr. Ballantyne replied that it was the practical test. He did not agree with Dr. Eccles that tests by the ear were wholly unreliable.

Mr. STAFFORD CRIPPS, K.C., summing up the defendants' case, said an attempt had been made by the plaintiffs to cloud the very simple issue with theories and tests which were quite immaterial and had no relation to the Hopkins patent. The only test, he submitted, was the test of the ear. He attacked the patent on the ground of invalidity, saying that the elements which went to the making of a loud speaker according to the Hopkins specification were common knowledge at the date of the patent. As to the form of the cone, there was no suggestion that the Hopkins cone was more advantageous than any other.

Mr. WHITEHEAD, K.C., replying on December 20th and 21st, on behalf of the plaintiffs, said the case for the defence had proceeded from beginning to end on the fallacy that a patent could be destroyed by agglomerating bits from a number of other documents. It was said that there was nothing new in the size, the coning, and the peripheral gripping, but he contended that Hopkins in his specification had described and claimed an article that was incontestably new.

At the conclusion of the arguments his Lordship reserved judgment.

# Reviews.

**The ABC of Storage Battery Management.** By E. C. McKINNON, M.I.E.E. Pp. 121; figs. 32. Manchester: The Chloride Electrical Storage Co., Ltd. Price 3s. 6d.

This is the second edition of an admirable handbook designed for the instruction of the non-technical user of storage batteries—whose name is legion in these days of motor-cars and wireless sets—and being written by a recognised expert, its teachings can be accepted with full confidence. It is true that the author is attached to a leading manufacturing concern, but that in no way detracts from the value of the book—rather the contrary, for it is obviously his first interest to inculcate the proper treatment of batteries in order to attain the best results, and as all lead storage batteries are identical in fundamentals, what is good for one is good for all. Special care has been taken to secure "simplicity both of language and explanation"; this aim, pursued too far, sometimes leads to ambiguity and lack of precision, but the author strikes a happy mean; whilst the book is not a "popular" manual, nor yet a "high-brow" treatise, it conveys the information necessary to satisfactory working in a clear and intelligible form, and without sacrificing technical truth to verbal convenience. In addition to a description of the construction and working of a lead storage battery, very full instructions for operating are given, and possible battery troubles are discussed; the information given is essentially practical and to the point, and the book is well worth the attention of everyone concerned with battery installation, use, and maintenance.

**The Essentials of Transformer Practice.** By E. G. REED. 2nd Edition. Pp. xii+392; figs. 185. London: Chapman and Hall, Ltd. Price 21s. net.

This is the second edition of Mr. Reed's excellent work, and it represents a very considerable improvement upon its predecessor, by virtue of the new matter it contains. If one is to judge by the lack of references to the original edition in the different articles on transformers published in the technical Press since its appearance, it would appear that the volume is by no means so well known as it should be. The earlier chapters deal with the history and fundamental theory of the transformer. In Chapter V the author treats of the general relations of the transformer, and this is a most valuable chapter to those who handle the engineering of general schemes as well as to the operators and designers of transformers.

Chapters VIII and IX give an approximate method of design for simple shell and core type transformers with rectangular iron and copper sections. The latter is quite new to the present edition and extends the arguments of the previous chapter by studies for determining the general expressions for dimensions and weights, for losses and costs as well as the conditions for minimum sum of losses and minimum costs with fixed densities. The application of the minimum conditions to simple shell and core type transformers is also given. In Chapter XII the author briefly reviews the heating of transformers, and while this is satisfactory so far as it goes, we should have liked to see a much more extensive treatment of the subject in view of the fact that the life of a transformer is that of its insulation, which in turn is dependent so largely upon the heating to which it may be subjected. In an all too short study Chapter XIII describes the general properties of insulating materials. Transformer insulation is discussed, rather inadequately we think, in Chapter XIV. Chapter XV, on the physical and mechanical properties of insulating oils, is another of the new contributions to the present edition, and besides indicating the classes of insulating liquids which might be used in transformer insulation, it outlines the properties and characteristics of petroleum oils and makes briefer reference still to chemical inactivity, oxidisation in oils, arc action on oil and reconditioning insulating oils. Chapter XVI, which is also new to this edition, deals with voltage (instrument) transformers and discusses the factors affecting ratio and phase angle. The theory of the current transformer is set out in Chapter XVII, and this also forms a welcome addition. Chapter XVIII deals exclusively with the phase angle of the current transformer. Current transformer calculations are given in Chapter XIX. The general theory of reactors is studied in Chapter XX, which deals with three types of coils. The chapter gives simply the fundamental design equations. Mechanical stresses in transformers are treated of in Chapter XXI, which we regret is so sketchy. The treatment, moreover, is confined to core-type transformers having concentric coils.

Chapter XXII is new to the present edition and it describes the procedure necessary for the installation and maintenance of transformers, including drying out and the care of insulating oil. Connections for voltage transformations for single-phase and three-phase transformers and groups are briefly summarised in Chapter XXIII, while in Chapter XXIV various methods of connecting single-phase transformers for three-phase transformation are described and illustrated by vector diagrams. The electrostatic stresses to which windings may be subjected in operation are described in Chapter XXXI, which shows the causes from which high electrostatic potential may result, and how the stresses are affected by transformer polarity. Chapter XXXII gives a brief description of the operation of current transformers with open-circuited secondaries. The pros and cons of loading transformers on a temperature basis are formulated in Chapter XXXIII, which directs attention to winding temperature gradient, continuous steady load operation, and operation with particular load cycles. The last three mentioned chapters are new to this edition. The remaining chapters of the book are the same as in the first edition.

While we have found the present volume to be full of interest and distinctly thought provoking, we have been struck with what has seemed to us a distinctly sketchy treatment of various aspects which have already been indicated. This we think is a pity, and while we realise that in very many instances so much could be said that it would be difficult to decide exactly where to stop, we would offer the suggestion that in a subsequent edition those chapters which we have indicated as having received all too brief attention, be re-written on more comprehensive lines. Better still, we think if the author would undertake a two or three-volume symposium dealing with all phases of transformer design, construction, testing, maintenance, and operation, he would, we are sure, earn for himself the grateful thanks of a large percentage of the members of the profession. The volume is attractively produced and represents extremely good value for money.

S. AUSTEN STIGANT.

**In These Days.** By ROBERT BRYMER. Pp. 302. London: Brentano's, Ltd. Price 7s. 6d. net.

Mr. Robert Brymer, of Siemens Electric Lamps & Supplies, Ltd., has for some years had opportunities for studying the problems that affect workers in industrial areas, and in his latest novel, "In These Days," he discusses the Communist menace in a great works employing thousands of hands. In the industrial city of Menster, Tim Turner, who has been brought up in an atmosphere of class hatred, enters an ironworks owned by a Quaker, with the avowed intention of ruining the capitalists. In his headstrong enthusiasm he mistakes his friends for his enemies, and unwittingly sides with alien Bolsheviks against the sympathetic and upright Quaker ironmaster. Discovering that his Bolshevik allies have bought up all the leading Communists of the city for political purposes and not in order to rectify the injuries done to the workers, or to rebuild the appalling slums in which he finds families starving on Christmas Eve, Turner, sincere through all his blind impetuosity, turns to his own employer and shows him how to better the condition of his employés. His drastic solution to the slum menace may not find universal favour, but the descriptions of the insidious methods employed to stir up discontent in factories and to disturb the friendly co-operation of employers and employed are written with sincerity and force.

**Accidents et Dangers de l'Electricité.** By Dr. PAUL DUHEM. Pp. x+74; 7 figs. Paris: Gauthier-Villars et Cie. Price 10 fr.

This little book—one of a series on the applications of electricity to therapeutics and kindred subjects—by a noted radiologist, editor of the series, is intended for the use of the general public as well as of medical men; it deals mainly with fatal accidents, concerning which so little exact knowledge is available, and which occur under conditions so variable that precise conclusions cannot be drawn from the data recorded. Death may ensue from the passage through the body of a current of 60 milliamperes and may not take place when a current of several amperes has flowed. A case is on record of a man whose body earthed a 5,000-volt a.c. line, fusing the line wire without killing the man, whose burns were healed in two months; in another instance a workman was subjected to a shock at 2,000 volts a.c., 48 cycles, for 20 minutes without losing consciousness or suffering any injury other than severe burns. On the other hand, men have been killed by contact with lines which had been switched off and earthed for safety's sake—the fatal shock being derived by induction from neighbouring high-pressure lines. The author points out that whilst the risks involved in other branches of industry are known and understood, those arising in the electrical industry occur in the most unexpected circumstances, and suggests that the public is still too little informed with regard to them, especially in connection with low-pressure installations, which, of course, are by far the most numerous and accessible; moreover, the proper methods of treating ordinary "casualties" are widely known, but the right way to deal with an electrical accident—including the protection of those who go to the rescue—is wholly different.

After studying the physiological action of electric currents, d.c. and a.c., Dr. Duhem discusses the "mechanism of death in electrocution," with many examples of experiments on animals in the longest chapter in the book. An analysis of statistical data which follows, shows that the great majority of accidents are due to the carelessness or ignorance of the victims, and the importance of "attention" is emphasised—if a person is expecting a shock, the effect of the shock when it comes is greatly diminished; probably it is this factor which accounts for the difficulty often experienced in the United States in the electrocution of criminals.

A chapter is devoted to the symptoms of electric shock, another to the consequential complications arising out of shocks which are not immediately fatal, and the last two respectively to the treatment of electrical accidents and the means of preventing them. The author commends the Schaefer method of artificial respiration, remarking that the victims of electric shocks are often "not so dead as they look," and that by proper treatment astonishing "resurrections" can often be brought about. Finally, he advocates the education of the public with regard to these matters.

The book is both interesting and practical, and we should be glad to see a translation or a similar work on the English market.

# Business and Industrial Notes.

## The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

### Associated Electrical Industries, Ltd.

At an extraordinary general meeting of the shareholders of the Metropolitan-Vickers Electrical Co., Ltd., on December 20th, the resolutions altering the company's title to "Associated Electrical Industries, Ltd.," and re-arranging the capital were confirmed.

### Industrial Relations in Australia.

The British Mission in Australia has been taking part in conferences having for their object the improvement in industrial relations. At Melbourne early in December Sir Hugo Hirst and Sir Arthur Duckham were able to make useful contributions to the discussions. Conditions in Australia, so frequently subject to labour disturbance, were compared with the state of affairs that prevailed in this country prior to the great dispute of May, 1926. Sir Hugo Hirst likened the present position in Australia to that in the United Kingdom when the Mond Conference was set up. That conference, he said, was one of open character. The Industrial Council had been formed to function permanently, and he expressed the hope that ultimately it would develop into a permanent official body in which both sides would have confidence. The Council functioned in cases of threatened trouble. The conference could in no way be interpreted as a concerted effort to reduce wages or to attack trade unionism. Ideas were being pooled, and every field was being explored with a view to mutual co-operation. A Sydney Press dispatch, dated December 12th, stated that Sir Hugo had suggested the sending of an Australian delegation to Great Britain in 1929 to study industrial conditions here. It was proposed that it should consist of four representatives of employers and four of trade unions, that it should be non-political, and that its expenses should be borne privately, £5,000 having been subscribed anonymously for the purpose of meeting the union delegates' expenses, the employers or their organisations bearing their own.

### Unemployment.

The Ministry of Labour returns for the week ended December 10th showed a decline of 29,900 in the number of unemployed. The total on the date mentioned was 1,320,900, as compared with 1,350,806 on December 3rd and 1,125,223 on December 12th, 1927.

### The Future of J. H. Holmes & Co.

Confident hopes for the re-organisation of Messrs. J. H. Holmes & Co., Newcastle, were expressed on Tuesday last week at a meeting of the staff and employés, together with Mr. W. Hall and Mr. N. D. Newall, members of the board. An apology was received from Sir A. N. Lindsay Wood, who was unable to be present. Mr. Wilfred Hall, who took the chair, gave a brief statement of the history and present position of the company and the aims and objects of the re-organisation. Mr. H. W. Clothier gave evidence of the support and co-operation of Messrs. A. Reyrolle & Co., Ltd. The new policies and the consequent prospects of important orders were announced by Mr. Robinson, and the employés expressed their goodwill and their sincere wishes for the successful future of the firm.

### Social Events.

The Venner Time Switches Sports and Social Club held its first fancy dress carnival dance, since the acquisition of its new sports ground at Croydon, in the Caxton Hall, Westminster, on December 17th. The affair was very jolly, and the colourful and original costumes very well deserved the handsome prizes which were distributed by Mrs. R. C. Graseby, wife of the managing director.

The directors of the Lothians Electric Power Company entertained their guests, members of the staff and their friends at an annual social at Seabeach House, Portobello, on December 18th. The function, which took the form of a supper and dance, was attended by a large company, who spent a most enjoyable evening. At supper Mr. H. C. Babb (general manager) proposed the health of the guests, and Mr. J. Jack, managing director of the Edinburgh Collieries Co., Ltd., responded.

Henley's Dramatic Club, whose performances are always so enjoyable, again gave a good account of themselves on Thursday, December 20th, when the three-act farce, "It Pays to Advertise," was rendered at the Cripplegate Theatre in Golden Lane, E.C.1. The play was produced by Mr. Henry Thornton.

### German Financial Enterprise.

The Gesellschaft für Elektrische Unternehmungen, of Berlin, which is an investment company interested both in electricity supply and manufacturing undertakings in Germany and is also extending its interests abroad, is about to increase its share capital by about 15,000,000 marks to 75,000,000 marks. It was stated at a recent meeting that besides the participation in the Belgian "Sofina" and the possibilities which these relations offered, the company had foreign financial plans of its own in course of preparation. In this connection it was most important to have funds already available. The American concerns, which operated with great financial resources, were pressing forward everywhere outside the United States in the electricity supply branch, and without regard to the present remunerativeness of the business, they were buying up all undertakings available with a view to the development of the sales of the manufacturing works closely associated with them. Under the circumstances the Germans were of opinion that the European industry, especially the German, must suffer from the Ameri-

can procedure in this respect. Therefore, they as a German company, wished to be equipped, to an extent which would not endanger the remunerativeness of the company, so as to be able to extend their sales business through the financing of undertakings.

### Shannon Scheme Contracts.

The *Irish Electrician* says that it is officially stated that during the past few months considerable progress has been made by the Free State Electricity Supply Board in getting its organisation under way for taking over the Shannon power works and high-pressure distribution system when they are completed next year. In the Greater Dublin area the contractors who are laying the high-power feeder cables are well advanced with the work. Contracts for the transformer kiosks and switchgear and for the erection of the transformers in this area were placed with Messrs. Ferguson, Pailin, Ltd., and the Asea Electric, Ltd. The work of erecting the distribution networks and house services in the 23 Leinster towns which it is proposed to supply this winter, is proceeding satisfactorily and will be finished before long. Considerable progress is also being made in Templemore, Tipperary, Cashel, Doon, Cappawhite, and Cappamore. The Irish Electrical Construction Co., which is carrying out the work in all these towns, has also received the contract for distribution networks and house services in Carrick-on-Suir, Lismore, Tramore, Cappoquin, Tallow, Dunmore East, and Passage East. The contract for the erection of transformer kiosks and switchgear in the Leinster towns was placed with the English Electric Co., Ltd., and for its immediate requirements in transformers the Board has decided to share the contract between the Asea Electric Co., Ltd., and the British Thomson-Houston Co., Ltd.

### Employment during November.

The December *Ministry of Labour Gazette* states that employment in the engineering industry during November remained very slack, and showed a further decline on the whole. There was an improvement in the Midland motor vehicle section and in electrical engineering employment continued fair. The number of unemployed in the engineering industry as a whole rose from 91,865 to 94,221, increasing the proportion from 9.4 to 9.6 per cent. The electrical section showed a slight improvement, there being a decrease of 10 (to 4,156) in the number unemployed; this was not large enough to affect the percentage (5.2). The other two electrical sections also recorded an improvement. In the electrical wiring and contracting industry the number of unemployed fell from 1,034 to 998, and the proportion from 6.7 to 6.4 per cent. The electric cable, wire and lamp manufacturing group showed a decrease of 157 (to 4,453), reducing the proportion of unemployed from 5.3 to 5.2 per cent.

### Conditions in Ecuador.

Mr. R. M. Kohan, British Chargé d'Affaires at Quito, has transmitted to the Department of Overseas Trade a report on the economic and financial conditions in Ecuador, dated September, 1928 (Stationery Office, 1s. net). In the course of this it is stated that the last three years has been a period of administrative reorganisation and progress, of financial stabilisation and economic stagnation. As the general standard of life in Ecuador is much inferior to European standards, the demand for articles of foreign manufacture is limited, and the saturation point is very quickly reached. Increased direct and indirect taxation has lowered purchasing power, and the prospects of an early recovery from the general paralysis of trade are not encouraging.

### Showroom Window Displays.

We reproduce herewith a photograph of a window display which recently secured a prize for the Newcastle and District

**Fig. 1.—A Newcastle Showroom Window.**

Electric Lighting Co., Ltd., in a competition organised by the Newcastle-upon-Tyne Advertising Club. The quaint little goblins with a "magic cave" in the background made a very simple and effective display.

A somewhat more complicated arrangement is shown in fig. 2, which depicts the showroom window of the Ringwood Electric Supply Co., Ltd. The main interest of this lies in the fact that the company operates in a rural district. It is

**Fig. 2.—A Window at Ringwood.**

a sign of the spread of electricity when dwellers in country districts can be persuaded to give electrical Christmas presents.

### Chinese Import Surtaxes.

A schedule of "interim surtaxes" is to come into force in China on February 1st next. Among the classes of goods affected are electric lamps and appliances, and telegraph and telephone materials, which are to be subject to a surtax of 7½ per cent. *ad valorem*. The surtax on electrical machinery, materials, and fittings not elsewhere specified is to be 5 per cent.

### The Scottish Lighting Service Bureau.

The third annual report of the Scottish Electric Lighting Service Bureau shows that during the past year the activities of the organisation have not only been well maintained, but that many new developments have been inaugurated. The total number of persons reached by the year's activities was 2,652, made up as follows: Attendance at lectures at the Bureau, 868; number of persons who called for advice, 332; number who attended illumination lectures organised by the Bureau elsewhere, 1,452.

### Central Board Contracts.

Two contracts valued at about £5,000 and £3,000, respectively, for the foundations of the towers for the crossing of the River Forth and the foundations of the sub-station at Yoker have been awarded by the Central Electricity Board to Messrs. MELVILLE, DUNDAS & WHITSON, Glasgow. Messrs. WILLIAM BAIN & Co., Coatbridge, have secured the contract for the foundations of the sub-station at Motherwell for just over £5,000, and Messrs. JOHN TRAIN & Co., Glasgow, for the foundations of the sub-station at Port Dundas for approximately £5,500.

### Recent Contracts.

The ELECTRIC HEATING Co., Croydon, has just completed a large contract for the supply of electric radiators for an important foreign naval power. The work has occupied a period of nearly ten months, during which period a special staff of mechanics have been fully employed on the work. The radiators are of the most modern type, the elements being carried in a specially constructed cradle to reduce the risk of fracture by gun-fire.

The ENGLISH ELECTRIC Co., LTD., has received an order from the Halifax Corporation Tramways for seven complete double-deck tramcars, with top covers, for mounting on four-wheeled trucks. The electrical equipment will comprise double 50-h.p. motors, controllers, "DK." magnetic brakes, and Maley and Taunton's air-break attachments. The order also includes a further six motors and controllers and three magnetic brakes.

Sir W. G. ARMSTRONG, WHITWORTH & Co., LTD., state that Messrs. Felten & Guilleame, Koln-Mulheim, have recently ordered "Monometer" patent 3-ton capacity cable furnaces, with all the latest improvements such as anti-oxidation system, automatic temperature control, and atmospheric siphon type burners. They have also received an order from the A.E.G. Cable Works, Oberspree, for a 3-ton "Monometer" cable furnace.

In modernising its power plant at the Ronez quarries, for more economical production of granite macadam and concrete building blocks, the JERSEY GRANITE & CONCRETE Co., LTD., of St. John's, Jersey, has installed Blackstone "spring injection" heavy-fuel-oil engines to the extent of 450 b.h.p.

### The G.E.C. Not to Manufacture in Australia.

In our leaderette of last week entitled "Sir Hugo Hirst and an Empire Manufacturing Group," we quoted a Melbourne Press dispatch crediting Sir Hugo with an announcement to the effect that his company, the General Electric Co., Ltd., proposed to establish a factory in Australia for the manufacture of electrical apparatus. We are informed that this report is not accurate, and that Sir Hugo's statement was only to the effect that British manufacturing companies would have to study seriously the question of manufacturing in Australia.

### Alleged American Radio Monopoly.

The Federal Trade Commission has dismissed the monopoly complaints against the General Electric, Radio Corporation, American Telephone and Telegraph, the Western Electric, the Westinghouse Electric, the International Radio Telegraph, and the United Fruit and Wireless Specialities Apparatus Company. All of these concerns were alleged to be monopolising the manufacture and sale of radio and other electrical equipment. The Radio Protective Association, representing independent concerns, in view of the fact that the Federal Trade Commission has decided that it is without jurisdiction to prosecute the Radio Trust, will now press the Department of Justice to bring the monopoly companies into Court.—*Exchange Telegraph* (Washington).

### For Sale.

Inverness Corporation Electricity Works has for disposal three steam generating sets. (See our advertisement pages today.)

### Book Notice.

"The All Europe 'Three': How to make a simple and efficient three-valve set." By C. M. R. Balbi, A.M.I.E.E. Pp. 24; 3 figs. and sheet of drawings. London: Sir Isaac Pitman & Sons, Ltd. Price 6d.

### Polish Foreign Electrical Trade.

During October last Poland imported "apparatus, conductors, and other electrotechnical materials" to the value of 8,576,000 zloty (about £200,000). The exports of the same class of goods were valued at 46,000 zloty (about £1,000).

### Large Steel Merger Foreshadowed.

Speaking at the annual meeting of Dorman, Long & Co., Ltd., last week, Sir Arthur J. Dorman (chairman) stated that negotiations with Bolckow, Vaughan & Co., Ltd., were proceeding with a view to an amalgamation if an equitable arrangement could be reached. Later in his speech Sir Arthur Dorman said that during the year 96,000,000 kWh of electricity had been generated at the company's Redcar works from blast-furnace gas and waste steam.

### Railway Goods Classification Changes.

Mr. J. W. Parker, A.M.Inst.T., who has contributed several articles on the subject of the transport of goods by railway to our pages, sends us the following note:—

The railways have recently proposed a number of alterations and reductions in the official classification of goods, some of which will go towards reducing transport costs. Electric cable until the last few months was in Class 16, but now a reduction is forthcoming for higher loads. If 5-ton *lots* are offered, the rate is reduced to Class 12, and if 2 tons is supplied, the division is 14. Aluminium scrap is also in Class 16, but skimmings have been reduced to Class 6. Electric regulating switches which also previously figured with the "B" reduction for owner's risk, have received the tonnage concession in the same way as cable, and now come in Classes 12 or 14, according to weight. This alteration does not apply to motor-starting switches. The generation of electricity is concerned with pulverised fuel, the charges for which have now been settled at a level 10 per cent. in advance of ordinary coal rates.

Among the additions to the classification are lamp sockets of earthenware and/or metal which are placed in Class 18; and iron or steel bobbins for cable or wire, and zinc wire, Class 13. Glass blocks for electric stoves when packed are placed in Class 12, but they are allowed to use any exceptional rates there may be for glass bottles. In the classification of electric trucks for baggage or freight, it was stipulated that the accumulators should not be charged, but this proviso is now withdrawn.

### Large-scale "Hire-Purchase."

The London Industrial Finance Trust, Ltd., which has recently commenced business at Farleigh House, Lawrence Lane, Cheapside, E.C.2, offers banking facilities to manufacturers and distributors of machinery to finance sales upon extended terms of payment—restricting these to productive machinery and equipment, and excluding business in goods like motor-cars sold for individual use. This would appear to be an extension of the possibility of carrying on business on the "hire-purchase" system which has become so important a factor in many classes of trade, but hitherto has been denied to the makers and buyers of expensive machinery installations. Use of the facilities offered will permit a buyer to make his machines begin to earn the money to pay for themselves, and will afford safety in extended terms of credit and payment by successive serial amounts to sellers and buyers alike. The chairman of the company is Col. the Hon. F. Vernon Willey, C.M.G.

### An "Ediswan" Lamp-Selling Idea.

An excellent scheme for encouraging the sale of "Ediswan" lamps has been circulated to dealers by the EDISON SWAN ELECTRIC CO., LTD. A new form of carton, holding six lamps, has been produced. In addition to being a strong cardboard container, this can be folded and arranged to form a model house. Two designs—Tudor and modern—are available, and they are attractively coloured. Moreover, in certain districts the company is distributing cardboard models of a garage and car to go with the house. The scheme is being advertised in about forty national and provincial newspapers.

### Great Britain's Radio Exports.

Some details of exports of radio apparatus from this country during October are given by the *Wireless Trader*. It is shown that the total value of British goods shipped during the month was £103,118, of which valves accounted for £13,906. Australia was the principal market, goods to the value of £13,448 (valves £9,159) going to the Commonwealth. Next in order was Holland with £10,385 (valves £71), and Rumania was third with £9,451 (valves £733). Other important customers were the Irish Free State, £5,812 (valves £4,897), India and Burma, £5,182 (valves £159), Canada, £4,515 (valves £809), Jugo-Slavia, £4,374 (valves £616), Belgium, £4,237 (valves £181), and France, £4,048 (valves £21).

### New Johnson & Phillips Headquarters.

We reproduce herewith a view of "Columbia House," Aldwych, W.C.2, into which Messrs. JOHNSON & PHILLIPS, LTD., moved this week from 12, Union Court, E.C. This new addition to the Kingsway area brings the day nearer when the district will be practically "all-electric." The telephone numbers of Messrs. Johnson & Phillips are now Holborn 8326-7-8.

**Messrs. Johnson & Phillips's New Premises.**
*Photograph by "Building."*

### American Electrical Industry in 1928.

Gen. Otto H. Falk, president of the Allis-Chalmers Manufacturing Company and a member of the Board of Governors of the National Electrical Manufacturers' Association, states that during 1928 the United States electrical industry enjoyed a period of steady growth. Its progress, particularly in relation to electrical machinery, was more along the line of improvements and refinements than in radically new developments. The higher efficiency and greater economy of large generating units was only possible through the concentration of power production in huge central stations. "Tying these stations together in systems and with systems interconnected and super-power chains, extending over vast distances, has brought the advantages of labour-saving, cheap and reliable electric power as well as light to a great majority of our citizens, in factory, shop, and home. The carrying of electricity to the rural community and farm, which has been given great impetus during the past few years, will be an important factor in the solution of our agricultural problems, in bringing the cheaper labour of power to replace human brawn and in bringing business methods as well as greater comfort and convenience to the farm. Electrification of important divisions of a number of great railway systems will prove a great impetus in the industry to concerns supplying equipment, as well as power. This, however, is a development of the future rather than the year just ahead. One of the most significant movements of industry, and particularly in the electrical branch, has been the getting together of all those having a common interest. Such associations as the National Electrical Manufacturers' Association are bringing the business men of the industry together for interchange of ideas, experiences, and methods. This is resulting in a standardisation of equipment, appliances and supplies, with a consequent saving in manufacturing costs, permitting a greater usage at lessening cost to the user. The virile spirit of its leaders with co-operation replacing competition will carry the electrical industry far along in the path of progress."

### Bankruptcy Proceedings.

W. H. BRADEN, 19, King's Road, Willesden Green, N.W.—The public examination of this debtor was held on December 20th before Mr. Registrar Francke at the London Bankruptcy Court, the accounts showing liabilities of £1,658 and assets nil. The debtor stated that in May, 1923, he began business from Balfour House, Finsbury Pavement, E.C., as an agent in wireless accessories; in March, 1924, he sold the business for £500 in shares of H. Braden & Co., Ltd., then formed with a nominal capital of £1,500, to acquire and carry it on. He acted as director of the company until August or September, 1926. He attributed his insolvency to liabilities incurred on behalf of that and another company. The examination was concluded. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| C. A. Daw & Sons, Ltd. | 45 | National Bank of South Africa ... ... ... | 310 |
| R. Harris ... ... ... | 375 | | |
| L. Hitchwik ... ... | 56 | G. Parwit ... ... | 790 |
| H. Kay ... ... ... | 55 | | |

A. A. WILLIAMS, 22, Elgin Mansions, Maida Vale, W.—This bankrupt, who failed in November, 1926, applied on December 18th to Mr. Registrar Stiebel, at the London Bankruptcy Court, for an order of discharge. The Official Receiver reported that the provable debts amounted to £1,328, and the estate had realised about £6. In February, 1923, the bankrupt became associated in the formation of Radio Phonopore and Electricals, Ltd.; he subscribed for 1,000 of the 5,000 shares, and was appointed managing director. Owing to the lack of working capital the bankrupt and two directors had recourse to a professional moneylender, from whom they borrowed £1,000 on a joint and several promissory note for £1,300, the money being used for the purposes of the company. Default was made by the company in payment of the first instalment, and judgment was signed against the bankrupt and his co-directors, with the result that the company went into voluntary liquidation in June, 1926, and proceedings were instituted against the bankrupt by the moneylender. The bankrupt attributed his failure and insolvency entirely to his liability on the promissory note. The discharge was suspended for three months on statutory grounds.

B. H. WISHAW, Bakewell Road, Matlock, Derbyshire, electrical and wireless engineer.—Liabilities of £346 were disclosed in the statement of affairs presented at the first meeting of creditors herein held recently at the Official Receiver's offices, Nottingham. The debtor attributed his failure to loss of money entrusted to an agent, and loss of money received by an employé and not accounted for. It appeared that he commenced trading in January, 1926, but in June, 1927, creditors pressed him and he arranged to pay through an agent liabilities amounting to £202 by monthly instalments. He had paid £180 to the agent, who, he alleged, had failed to pass on the money to the extent of about £100. The matter trical and wireless engineer.—Liabilities of £346 were diswas left in the hands of the Official Receiver as trustee. The public examination was held on December 18th, at the Court House, Derby, and was adjourned so that particulars could be filed with regard to the moneys said to be unaccounted for by the agent.

F. PRICE & C. R. TARVER (F. Price, Tarver & Co.), electrical engineers, 15, Working Street, Cardiff.—First meeting, December 31st, at 34, Park Place, Cardiff; public examination, January 10th, at the Law Courts, Cardiff.

H. J. BROWNHILL, electrical engineer, 34, Broadstone Avenue, Leamore, and 181, Bloxwich Road, Walsall.—Receiving order made December 18th, on debtor's own petition.

R. G. ROBERTS, electrical engineer, Magnet House, College Road, Upper Bangor.—Trustee, Mr. I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester, released December 10th.

J. A. HARTIGAN and G. J. D. HARTIGAN (London Fan and Motor Co.), electrical engineers, 81, Charlotte Street, Tottenham Court Road, W.—Last day for proofs for dividend, January 4th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1.

P. G. CRUMP ("Dales"), wireless dealer, &c., 44, Wylecop, Shrewsbury.—First and final dividend of 3s. 1d. in the £, payable December 31st, at the Official Receiver's offices, 22, Swan Hill, Shrewsbury.

H. H. SPEKE, electrician, 12 to 17, Bilston Street, Wolverhampton.—First and final dividend of 5s. 4d. in the £, payable January 14th, at 3, Warwick Passage, Corporation Street, Birmingham.

W. A. HAMMOND, wireless dealer, 31, Middle Street South, Great Driffield.—Last day for proofs for dividend, January 5th. Trustee, Mr. J. E. D. Stickney, Official Receiver, 37, Scale Lane, Hull.

C. H. DAVIES, electrical engineer and contractor, &c., 6, Stamford Arcade, Ashton-under-Lyne.—First and final dividend of 1s. 4d. in the £, payable December 31st, at the Official Receiver's office, Byrom Street, Manchester. (The above notice cancels that announcing a dividend of 1s. 4½d. in the £, published in the *London Gazette* of November 13th, 1928, the dividend then advertised not having been paid.)

W. T. LACEY, electrical engineer and contractor, 10, George Street, Bath.—First and final dividend of 2s. 4d. in the £, payable December 31st at the Official Receiver's office, 26, Baldwin Street, Bristol.

S. SMITH (Smith & Sons), electrical engineer, general dealer, &c., 22a, 24, and 26, Victoria Square, Widnes.—First and final dividend of 2s. 8d. in the £, payable at the Government Buildings, Victoria Street, Liverpool.

J. E. CRACKNELL, wireless supplies dealer, &c., High Street, Manningtree.—Trustee, Mr. H. S. Gotelee, Official Receiver, 9, Arcade Street, Ipswich, released December 10th.

### Company Liquidations.

EASTNOR TRAMWAY TRACTION AND ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. A. J. Adams, National Buildings, St. Mary's Parsonage, Manchester. Meeting of creditors, December 28th, at the offices of the liquidator. Particulars of claims by December 27th.

BELCO, LTD.—Winding up voluntarily. Liquidator, Mr. S. Thompson, 23, Bush Lane, E.C.4. Meeting of creditors, January 4th, at the office of the liquidator. (This notice is purely formal; all creditors have been or will be paid in full.)

VACUUM LIGHT & POWER, LTD.—A meeting of creditors was held on December 21st at 146, Bishopsgate, E.C.

HELIKON WIRELESS CO., LTD.—First meeting of creditors and contributories, January 4th, at 29, Russell Square, W.C.

BRITISH TELEGRAPHONES, LTD.—Winding up voluntarily. Liquidators, Mr. H. V. Creighton and Mr. J. Gardiner.

### Dissolutions of Partnership.

LONDON AUTOMOBILE ELECTRIC SERVICE, automobile and electrical engineers, 383, City Road, E.C.—Mr. A. E. Newton and W. E. Collins have dissolved partnership. Mr. Collins will attend to debts and continue the business under the style of the London Auto Electric Service.

ROYAL RADIO CO., manufacturers of wireless apparatus, 4 and 5, Dorset Mews North, Upper Gloucester Place, N.W.—Mr. D. W. Morphy and Mr. R. G. McCall have dissolved partnership. Mr. Morphy will attend to debts and continue the business.

S. W. BLIGH, radio and electrical engineers, 1 and 2, North Lane, Canterbury.—Mr. S. W. Bligh and Mr. J. Fullagar have dissolved partnership. Mr. Bligh will attend to debts and continue the business.

### Local Exhibition.

DILTON (WILTS.).—The Western Electricity Supply Co., Ltd., held an electrical exhibition at Dilton from December 17th to 19th as an official inauguration of the supply to the village. The exhibition was organised to enable the public to see some of the uses of electricity, and demonstrations of electric cooking, ironing, cleaning, &c., were given.

### The Timber Market.

Our Timber Trade Correspondent reports that business in the Metropolitan wood market has been very brisk for the time of year, but more European wood has arrived to keep stocks in ratio with consumption. Receipts throughout the year, however, have been exceptionally light compared with 1927, which was a record year for shipments of timber to the United Kingdom, and a little smaller than in 1926. Stocks are likely to be low, and therefore in favour of holders, during the winter and early spring, as principal shipping ports are now icebound. Mahogany and other fancy hardwoods keep very firm in value, with stocks on the light side. American lumber arrivals, also, are getting small, as, gradually, are stocks, whilst American exporters are adopting a very firm attitude in their home trade, which is being felt on the market this side. Some good Empire woods, from Australia, West Africa, British Honduras, and other of our outposts, are obtainable at reasonable prices from high-class merchants.

### Trade Relations with Russia.

An article upon this subject appeared in the *Financial Times* of December 19th. In it two views were put forward, one by "a prominent banker," the other by "an authority on international affairs." The banker expressed the opinion that conditions in Russia were worse than they were a year ago, so that apart from any sentimental reasons, the extension of credits to Russia at present did not appear justifiable. "What British bankers want to see, before such credits can be granted, is more conclusive proof that the present Soviet *régimé* is, first, fundamentally honest, and, second, a successful economic mechanism." The view of the other authority is that the conditions of the peasants, who form the large majority of the Russian population, are little different, save in the ownership of land, from what they were under Tsarist rule. "Thus it is to the peasant and his requirements that attention must be paid." Referring to the adverse influence in the past of the Third Internationale, the authority says that this barrier to trade still exists but is not insuperable. The solution is undoubtedly to see that it pays Russia to establish her good will. "It is not the sentiment, at least, of British capital, to extend any long-term credits to Russia at the present juncture and under the ruling uncertainty. More should be known of actual conditions, and it is believed that a British economic delegation to Russia, with its object to review that country's rehabilitation possibilities, would be greatly welcomed by the Soviet. Whether such a deputation would report favourably or otherwise upon the prospects of any credit schemes it is impossible to say. Should the result be favourable, the restoration of economic relations between the two countries would be essential." Speaking at a recent meet-

ing, Mr. R. J. G. Boothby, M.P., private Parliamentary secretary to Mr. Winston Churchill, said that neither the internal situation in Russia nor the form of Government was our affair. We were only concerned with propaganda and debts. It was upon the solution of those two questions that the future of Anglo-Russian relations depended. The first step lay with the Soviet Government; and the next with our financiers and industrialists.

### Glasgow and Foreign Cables.

At the last meeting of the Glasgow Corporation the Tramways Committee recommended the acceptance of a tender for cable by the Felten & Guilleaume A.G., Germany. A member of the Council moved that the recommendation be referred back, stating that a few weeks ago there was great indignation when a similar proposal was made. He was anxious to know the reason for this change of attitude. The convener of the Committee said that the foreign offer was £242, and the lowest British offer £367. Moreover, 14 British firms had sent in tenders which were practically identical at about £576. The foreign cable had been tested by the management, and was reported satisfactory, and they felt that the time had come when the Tramways Department should be protected against rings and combines. The amendment was withdrawn and the minute approved.

### Registered Electrical Contractors.

Applications from the following for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Hough, N., Manchester.
Napier, F. L., & Co., Ashton-on-Mersey.
Richardson, T. A., Arklow, Co. Wicklow.
Santone Electrical Co., Leeds.
Cotton, G. A., Hebden Bridge (Yorks.).
Jennings, F. H., Dudley (Worcs.).
Cresswell, F., Mansfield (Notts.).
Bristow, L. & E., Ltd., Knightsbridge, S.W.1.
Watt, G., Newcastle-on-Tyne.
Wilson, A. J., & Sons, Leeds.
Camidge, A. R., & Co., Stoke Newington, N.16.
Silcox, G., Leeds.

At the same meeting six applications were declined.

### New Catalogues and Lists.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Ta175, containing lists of orders placed for various types of the company's transformers Illustrated.

DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.2.—A well-illustrated and priced catalogue (No. 461) of radio sets and apparatus of many makes.

"ELECTRADIX RADIOS," 218, Upper Thames Street, E.C.4.—A descriptive price list of Government surplus radio and electrical apparatus.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—Two well-produced catalogues (Nos. 12 and 13), dealing, respectively, with hand-operated and automatic d.c. motor control gear.

THE ELECTRIC DEPÔT, LTD., Pritchett Street, Aston, Birmingham.—Two illustrated and priced pamphlets, advertising the company's battery-charging apparatus.

THE STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, E.C.4.—A handsomely-produced brochure dealing with the company's organ-blowing equipment. The equipment and a number of cathedrals, churches and other buildings in which it has been installed are beautifully illustrated.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A circular containing some particulars of telephone cable contracts carried out for the G.P.O. and the Luxemburg Government.

MR. J. R. MORRIS, Imperial House, Kingsway, W.C.2.—A priced and illustrated leaflet advertising the "Morris" electric lantern and "Columbia" dry cells for employment with it.

The BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A priced and illustrated folder dealing with "Mazda" daylight blue automobile headlight bulbs, arranged for overprinting.

### A Deal in Hydro-Electrics.

Under this title the *Financial News* last week reported the public examination at the London Bankruptcy Court of Mr. Asher Weber, who failed in September last, with liabilities of £1,893 and assets *nil*. Replying to Mr. Gaine (Official Receiver), the debtor stated that in 1903 he went to the United States, where in New York he earned a living by speculating in stocks and shares until 1908. In that year he lost all his money, and returned to this country without means. He commenced to speculate in London; he had no office, employed no staff and paid no income tax, although he made a profit of £200 to £300 a year. He met his obligations to the stockbrokers until the first settling day in June last. During the previous three months he had speculated in Hydro-Electric shares, which were controlled by the late Mr. Loewenstein. He bought shares at $66.75 to $84.50, and after Mr. Loewenstein's death he had to sell at $54.50, with the result that he was unable to meet the differences.

The Official Receiver asked the debtor how he carried on business without an office or books, and he replied that he was one of ten thousand in the City who earned a livelihood in that way. The examination was concluded.

### Trade Announcements.

The address of Mr. HENRY JOSEPH is now 11, Red Lion Square, High Holborn, W.C.1. Telephone: Chancery 8770; telegrams: "Lockabinet, Holb., London."

The London office of HIGGS MOTORS has been removed to Dudley House, 36-38, Southampton Street, Strand, W.C.2. Telephone: Gerrard 8516.

The FOREST CITY ELECTRIC CO., LTD., has removed to 4, Longford Street, Stretford, Manchester.

To-day (Friday) the REVO ELECTRIC CO., LTD., is removing its London branch to larger premises at 30, Great Queen Street, W.C.2, with a trade entrance in Parker Street. The new telephone numbers are Holborn 9076 and 9077.

BRITISH INSULATED CABLES, LTD., announces that at the New Year it is transferring its commercial and counting-house staffs from Helsby to the registered office at Prescot. Consequently all correspondence relating to estimating, buying, inquiries, orders, accounts, remittances, &c., should be sent to Prescot as from January 1st.

### New French Companies.

A new company has lately been formed at Dinan, Brittany, with a capital of 1,600,000 fr. and the title La Société Hydro-Electrique de la Haute Rance, to establish a hydro-electric station at Rophemel (Côtes du Nord).

A company has been formed in Pau with a capital of 500,000 fr. and the title La Société de Constructions Electriques des Pyrenées, to carry on an electrical engineering business in the South of France.

### Italian Amalgamations.

The tendency for the amalgamation of electrical undertakings in Italy continues. A fusion of the interests of the Società Italiana per Imprese Elettriche "Dinamo"; the Società Elettrica Ossolana; the Società Elettrica del Pollino; the Azienda Elettrica Alliata; and the Unione Consumatori Energia Elettrica "Luce," has recently been effected. An amalgamation has also taken place between the Società Elettrica del Valdarno; the Società Elettricita Etruria, Chiuri; and the Società Elettrica Aretina, Arezzo.

### Calendars and Diaries.

Messrs. FREDK. HODGSON & CO., LTD., 24, Queen Victoria Street, E.C.4, have sent us a wall calendar with monthly slips for 1929, the pictorial feature of which is a study of a happy little fellow not yet facing the problems of the electrical industry. "Cock of the Walk" they call him.

A picture by W. H. Margetson—"From Jest to Earnest"—forms the subject of a calendar received from Mr. L. W. FOOTE, 30, Charles Street, Cardiff. A pierrot and a girl in tender mood.

A neat vest-pocket diary for 1929 has been issued by the WESTINGHOUSE ELECTRIC INTERNATIONAL CO., 2, Norfolk Street, Strand, W.C.2. It contains addresses of all Westinghouse branches throughout the world, particulars of the company's subsidiaries and manufactures, and a map of the world showing aerial distances between principal places.

A delicately-coloured drawing by W. H. Margetson is employed for their 1929 calendar by Messrs. MAWDSLEYS, LTD., Dursley, Gloucestershire. The subject is "The Sleeping Beauty." We think that the lady might have had a more comfortable situation for her lengthy repose, but, of course, she had no choice.

The company's productions are exemplified in a calendar with serviceable monthly date slips sent us by Messrs. ERNEST F. MOY, LTD., Greenland Place, Camden Town, N.W.1.

Utility is the keynote of the 1929 calendar of Messrs. T. J. GRAINGER & CO., LTD., 20, Eldon Square, Newcastle-on-Tyne, which has daily slips with extra large figuring.

Mr. V. G. BUREITT, 105, Redcliffe Street, Bristol, has sent us a calendar with boldly-figured monthly sheets.

The EDISON SWAN ELECTRIC CO., LTD., Queen Victoria Street, E.C.4, has sent to its friends a neat pocket diary containing a great deal of business and general information.

The calendar received from Messrs. HILDICK & HILDICK, Walsall, is a representation of a bundle of screwed tubes with a block of daily slips.

Two very *décolleté* ladies, one of whom is playing a "Columbia" torch on an aeroplane, appear on a calendar received from Mr. J. R. MORRIS, Imperial House, Kingsway, W.C.2.

From Messrs. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, we have received one of their conveniently spaced diaries with alternate blank pages. The use of this diary has become a habit with us, and it is always welcome.

Messrs. A. REYROLLE & CO., LTD., have chosen for a souvenir a morocco-bound refill notebook, just the right size for the pocket.

The 1929 calendar of the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1, consists of large monthly sheets bearing illustrations of the classes of work carried out by the company.

Messrs. FRANCIS POLDEN & CO., LTD., 56, Cannon Street, E.C.4, have again sent us a handsome pocket diary with a fold-over cover. This contains ample memoranda space and general information.

The appointments diary of the LONDON UNDERGROUND RAILWAYS is a handsome volume containing a large number of excellent photogravure illustrations of scenes, *objets d'art*, and other interesting features of the London district, accompanied by aptly chosen quotations from literary works—so tasteful a production that to mar its beauty with memoranda is unthinkable.

A neat calendar for 1929 received from the KEY ENGINEERING CO., LTD., serves also as an inch and centimetre scale.

The HART ACCUMULATOR CO., LTD., of Stratford, London, E.15, has, as in previous years, provided its friends with a desk blotting pad, each sheet bearing the complete year's calendar.

The MARCONIPHONE CO., LTD., has sent us a "daily calendar," mounted on an emblematic circular board.

Views of the firm's workshops appear on the 1929 calendar of the WALKER ELECTRICAL SERVICE, Annandale Street, Edinburgh. Large monthly date sheets are provided.

A desk daily engagement block for 1929 has been received from Messrs. LEISTIKOW, ALLISON & LYON, 18-19, Southampton Buildings, Chancery Lane, London.

Messrs. ARTHURS, of 110, Charing Cross Road, W.C.2, have sent us a wall calendar with monthly sheets, each bearing a humorous subject in colour.

A handsome leather bound calendar with a magnetic date indicating device has been received from Messrs. TYLER & CO., LTD., Ashwin Street, Dalston, E.8.

A small wall calendar with monthly date slips has reached us from the "SOLUS" ELECTRICAL CO., Judd Street, W.C.1.

### Prices of Materials.

**The following prices are only general, and they may vary according to quantities and other circumstances:—**

| | CHEMICALS, &c. | Price Dec. 24th. | Fortnight's inc or dec. |
|---|---|---|---|
| a | Acid, Oxalic ... ... ... ... per lb. | 5¾d. | ... |
| a | Ammoniac, Sal ... ... ... per ton. | £60 | ... |
| a | Ammonia, Muriate (large crystal) ,, | £52 | ... |
| a | Bisulphide of Carbon ... ... ,, | ... | ... |
| a | Borax ... ... ... ... ... ,, | £25 | ... |
| a | Copper Sulphate ... ... ... ,, | £25 10s. | ... |
| a | Potash, Chlorate ... ... ... per lb. | 8½d. to 4d. | ... |
| a | ,, Perchlorate ... ... ,, | 5½d. | ... |
| a | Shellac ... ... ... ... per cwt. | £18 10s. | ... |
| a | Sulphur, Commercial ... ... ,, | £11 | ... |
| a | ,, Roll ... ... ... ,, | £11 | ... |
| a | Soda, Chlorate ... ... ... per lb. | 3d. | ... |
| a | ,, Crystals ... ... ... per ton. | £5 to £5 5s. | ... |
| a | Sodium Bichromate, casks ... per lb. | 3½d. | ... |
| | METALS, &c. | | |
| b | Aluminium, Ingots ... ... per ton. | £95 to £100 | ... |
| b | ,, Wire ... ... ... per lb. | 1/3 to 1/9 | ... |
| b | ,, Sheet ... ... ... ,, | 1/3 to 2/9 | ... |
| p | Babbitts Metal and Anti-friction Metal— | | |
| | Grade I ... ... ... per ton net. | £203 | ... |
| | Grade II ... ... ... ... ,, ,, | £141 | ... |
| | Grade III ... ... ... ,, ,, | £74 | ... |
| c | Brass (rolled metal 2' to 12' basis) per lb. | 10¾d. | ... |
| c | ,, Tubes (solid drawn) ... ... ,, | 1/- to 1/0½d. | ... |
| c | ,, Wire, basis ... ... ... ,, | 10¾d. | ... |
| c | Copper Tubes (solid drawn) ... ,, | 1/1½ | ... |
| c | ,, Bars (best selected) ... per ton. | £98 | ... |
| c | ,, Sheet ... ... ... ,, | £98 | ... |
| c | ,, Rod ... ... ... ... ,, | £98 | ... |
| d | ,, (Electrolytic) Bars ... ... ,, | £75 5s. | ... |
| d | ,, ,, Sheets ... ... ,, | £143 10s. | ... |
| d | ,, ,, Wire Rods ... ,, | £85 5s. | ... |
| d | ,, ,, H.C. Wire per lb. | 1s/7½d. | ... |
| f | Ebonite Rod ... ... ... ... ,, | 2/3 to 2/6 | ... |
| f | ,, Sheet ... ... ... ... ,, | 2/3 to 2/6 | ... |
| n | German Silver Wire ... ... ... ,, | 2/2 | ... |
| h | Gutta-percha, fine ... ... ... ,, | nom. | ... |
| h | India rubber, Para fine ... ... ,, | 10½d. | ½d. inc. |
| i | Iron Pig (Cleveland No. 3.) ... per ton. | 75/- | ... |
| i | ,, Wire, galv. No. 8, P.O. qual. ,, | £21 | ... |
| g | Lead, English pig ... ... ... ,, | £23 10s. | 5/- inc. |
| g | Mercury ... ... ... ... per bot. | £22 5s. to £22 15s. | ... |
| e | Mica (in original cases) small ... per lb. | 3d. to 3/- | ... |
| e | ,, ,, medium ,, | 4/- to 8/- | ... |
| e | ,, ,, large ... ,, | 10/- to 20/- & up | ... |
| p | Phosphor Bronze, plane castings ,, | 1/3½ | ... |
| p | ,, ,, drawn bars & rods ,, | 1/3½ | ... |
| p | ,, ,, rolled strip & sheet ,, | 1/3½ | ... |
| p | ,, ,, wire... ... ... ,, | 1/4½ | ... |
| o | Platinum ... ... ... ... per oz. | £15 5s. | ... |
| d | Silicium Bronze Wire ... ... per lb. | 11½d. | ... |
| r | Steel, Magnet, in bars ... ... ,, | 7½d. | ... |
| n | Tin, Block (English) ... ... per ton. | £223 10s. to £224 | £3 to £3 5s. dec. |
| n | ,, Wire, Nos. 1 to 16 ... ... per lb. | 3/11 | ... |

*For 1 cwt. lots. Special quotations against definite specifications.

**Quotations supplied by**

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Reporting on December 22nd, Messrs. James Forster & Co. stated that the market last week was almost entirely professional, consumers being little disposed to make purchases in view of the approach of the holidays. Arrivals were plentiful, but prices kept up remarkably well. Demand will probably improve after the holidays, which in turn may bring about firmer conditions.

### Large New American Cable Factory.

It is reported that the Western Electric Company is to erect a plant costing $15,000,000 at Baltimore, Maryland, to manufacture telephone cable and wire. The initial construction will provide plant, buildings and equipment capable of producing 110,000,000 conductor feet of cable weekly, the capacity being expressed in terms of the number of feet of wire in the finished cable. Approximately 1,500 workers are to be employed at first and the number will be increased as fast as new buildings can be erected. It is expected to complete the first unit in the latter part of 1929.

# Lighting and Power Notes.

**Banff.**—ELECTRICITY SUPPLY.—The Town Council is to make application for the insertion of a clause in the Grampian Electricity Bill providing for a time limit for the company to commence to supply electricity. This decision was arrived at after the receipt of a letter from the Electric Supply Corporation, Ltd., stating that it did not propose to proceed further in the matter of an electricity supply undertaking for the burgh. The company stated that the position was somewhat complicated by the knowledge that probably three other parties were coming forward with proposals of a like nature. Such intense competition would necessitate eventually the holding of an inquiry by the Electricity Commissioners, and probably an appearance before the Parliamentary Committee on Scottish Provisional Orders. It did not care to face the expense and trouble of carrying it through in view of the circumstances mentioned.

**Bedfordshire.**—ELECTRICITY IN BULK.—The Bedford Corporation Electricity Committee has reported that the transmission line for the supply of electricity in bulk to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., is being provided by the Central Electricity Board, which is now proceeding with the erection of a section of the "grid" between Bedford and Little Barford, to be operated, temporarily, at 33,000 V. The Board prefers that the Corporation and the company should agree to terms for a direct bulk supply rather than that the Corporation should sell electricity to the Board for the supply by the Board to the company. The latter authority has intimated that its requirements through the Corporation's mains to Sandy this winter will not be more than 300 or 400 kW. This supply is used for distribution in the St. Neots, St. Ives, and Huntingdon areas, and the company estimates that the maximum load for this winter through the Board's transmission line will be 2,900 kW.

**Birtley (Durham).**—STREET LIGHTING.—The Parish Council has decided to approach the Durham County Council and the Ministry of Health for sanction to borrow £2,600 for the installation of electric street lighting in the township.

**Brierfield.**—CHANGE-OVER.—The Urban District Council has appointed Mr. G. F. Naylor, borough electrical engineer of Nelson, as consulting engineer for the electricity conversion scheme.

**Colchester.**—NEW PLANT.—The City Council has decided to apply for consent to the installation at the generating station of a 4,500-kVA, 6,600-V turbo-alternator and auxiliary plant.

**Colwich (Staffs.).**—INAUGURATION OF SUPPLY.—An electricity supply for the district has been provided by the Trent Valley and High Peak Electricity Co., Ltd., and was recently inaugurated by Mrs. O'Sullivan, chairman of the Parish Council. Mr. C. Jones, resident manager of the company, stated that in carrying the supply to Colwich, 320 poles were erected, whilst 11 miles of overhead lines and 4 miles of underground cables were also used. The supply was generated at the Brereton Colliery, where there was an efficient power station of ample capacity to meet requirements in the area for many years to come unless some unforeseen demand was made upon the company. If the necessity arose, the company would extend its plant. The company was desirous of extending its supply to Weston, Abbots Bromley, and Brocton.

**Costa Rica.**—HYDRO-ELECTRIC DEVELOPMENT.—The Government has ordered a survey of the Ujarraz waterfall with a view to erecting a hydro-electric station to supply electricity to San José, Cartago, Heredía, Tres Rios, and several other neighbouring towns. The falls are estimated to be capable of producing 32,000 h.p.—*Reuter's Trade Service* (San José).

**Coventry.**—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £22,500 for mains.

**Dalkeith.**—PROPOSED PURCHASE.—The Town Council recently considered proposals from the Lothians Electric Power Co., Ltd., for the sale to that company of the burgh electricity undertaking. The Council agreed to communicate with the company with a view to obtaining further information.

**Glasgow.**—ELECTRICITY SUPPLY.—In connection with the proposed alteration in charges by the Clyde Valley Electrical Co., the Corporation Electricity Committee at its last meeting

had under consideration a letter suggesting that steps should be taken to consider the advisability of having the whole of the electricity supply within the municipal area brought under civic control. After discussion it was agreed to remit the whole question to the Town Clerk and the manager of the Electricity Department for report.

**Hereford.**—ELECTRICITY SUPPLY.—The mains are to be extended to Kington in order to supply electricity to that town. A new hire-purchase system in connection with wiring installations for private houses and other premises is to be put in force, and for this purpose £2,000 is to be borrowed.

**Irish Free State.**—DUBLIN.—At a meeting of the City Commissioners on December 15th, a recommendation was adopted that application be made to the Electricity Supply Board to sanction the expenditure of a sum of £148,636, which, with an interim sanction already given for £22,268, makes a total of £170,904, to cover the ordinary capital requirements of the electricity undertaking from July 1st, 1928, to December 31st, 1929. The present application includes no new work of any kind, but is necessitated by the normal growth of the distribution system. A separate application will be made covering the provision for approximately 5,000 kW of generating and steam-producing plant. The cost of this proposed installation is £138,000.

**Japan.**—ELECTRICAL DEVELOPMENT.—The Nippon Denryoku K.K. has completed the installation of one 44,000-kW turbo-generator, four 44,000-kVA transformers, and three boilers at its Amagasaki power station. This station now has a capacity of 100,000 kW. It is reported that the Kobe Prefectural Electric Bureau proposes to erect a hydro-electric power station which will have a capacity of 110,000 kW, consisting of two 35,000-kW and two 20,000-kW sets.

**Korea.**—ELECTRICAL DEVELOPMENT.—The President of the Bank of Chosen states that work has commenced on the construction of a hydro-electric power station in North Korea which will have a capacity of 170,000 kW. The erection of two additional stations in the same area of 200,000 and 300,000 kW are also proposed.

**Lichfield.**—ELECTRICITY SUPPLY.—The electrical engineer has prepared specifications and estimates for the proposed extensions at Shenstone, the total cost of which is estimated at £2,850, and the scheme is to be submitted to the Electricity Commissioners for approval.

**London.**—ST. PANCRAS.—The Borough Council Electricity and Public Lighting Committee has recommended that an agreement be entered into with the *Daily Sketch and Sunday Graphic*, Ltd., for a stand-by supply of 400 kW to its premises in Gough Street, Gray's Inn Road, and that application be made for sanction to a loan of £8,000 for the additional mains required.

BERMONDSEY.—The annual report on the working of the electricity undertaking for the year ended March 31st last shows that the electricity sold amounted to 14,715,609 kWh, an increase of 2,178,783. The revenue per kWh sold was 2.1d.—the same as in the preceding year, and the working cost per kWh sold was 1.54d. (1.75d.). The number of new consumers connected was 2,033. The gross profit was £39,135, and after providing for capital charges, &c. (£40,078) there was a deficiency for the year of £943. The net deficiency on revenue account at March 31st last was £11,509.

STOKE NEWINGTON.—The Finance Committee recently recommended to the Borough Council that application be made for sanction to loans of £10,000 for mains and services and £1,500 for free wiring installations.

The Electricity Committee has received a report from the borough electrical engineer outlining two alternative schemes to meet anticipated future demands for electricity. The capacity of the plant at present installed (excluding a steam set) is 3,640 kW, and with the largest set out of commission, the plant available would be 2,640 kW. The engineer estimates that the maximum load by March 31st, 1930, will be 3,270 kW, and proposes, therefore, that either the plant be extended and the present system of conversion be continued at an estimated cost of £54,088, or that a transformer station be erected and the system changed over from d.c. to a.c. at an estimated cost of £76,170. The latter scheme would be put into operation in three sections, and the total change-over would not be completed until about 1938. The Committee recommended that Mr. A. M. Sillar, consulting engineer, be engaged to advise the Council as to the best method to be adopted. The Council has adopted the Committee's proposals.

**Newcastle-on-Tyne.**—ELECTRICITY CHARGES.—A special conference of fourteen local authorities met at Newcastle on December 18th to consider what steps should be taken towards obtaining a reduction of the electricity charges on Tyneside. The Lord Mayor presided, and representatives were assembled from Newcastle, Gateshead, Jarrow, Wallsend, Whitley Bay and Hebburn. The Town Clerk of Newcastle emphasised the difference in the cost of electricity in Newcastle (6d. per kWh) and other provincial towns which paid on an average 4½d. per kWh. Sir George Lunn, chairman of the Parliamentary Committee of Newcastle Corporation, proposed the following resolution: "That the charges of the local electricity supply companies are far in excess of the necessities of the area and as a substantial and immediate reduction is imperative, the conference appoint a deputation to confer with the representatives of the local electricity companies and to report the result of their negotiations to a subsequent conference. The resolution was passed unanimously. The appointed deputation will consist of two delegates from each authority represented at the conference and also two officials from Newcastle and Gateshead, and it is hoped that an interview will be obtained with representatives of the companies early in the New Year.

**Oldham.**—ELECTRICITY CHARGES.—The Corporation Electricity Committee has adopted the following new tariffs: Shop lighting: Electricity consumed between 4 p.m. and 8 p.m., 5½d. per kWh; between 8 p.m. and 4 p.m., 2½d. per kWh. Outside shop window lighting, advertising signs, &c.: Electricity consumed between midnight and 6 p.m., 4½d. per kWh; between 6 p.m. and midnight, 2d. per kWh.

**Paignton.**—STREET LIGHTING.—The Corporation has accepted the tender of the Paignton Electric Light and Power Co., Ltd., for the lighting of the streets in the district by electricity.

**Price Reductions.**—Reductions in the charges for electricity have been made or recommended in the following districts:—

BEXHILL.—Lighting: From 5d. to 4½d. per kWh.

HECKMONDWIKE.—Heating and cooking: From 1½d. to 1d. per kWh.

SHOREDITCH.—Shop-window lighting and electric signs: 6d. per kWh for the first 1½ hours' average daily use, and 1d. per kWh for all electricity consumed after that period.

**Rhyl.**—INQUIRY DECISION.—According to the *Manchester Guardian*, the report of the inspector of the Ministry of Transport, who recently held an inquiry into a proposal to erect overhead cables at Rhyl, having been considered by the Electricity Commissioners, the Minister of Transport has informed the Urban District Council, which objected to the proposal, and the promoting company, that he withholds his consent to the greater part of the scheme, but gives it as to a small portion. It is understood that the refusal applies to main roads and residential districts, and the sanction to the non-residential parts.

**Seaham Harbour.**—LOAN SANCTIONED.—The Urban District Council Electricity Committee has received sanction to a loan of £3,000 for the assisted wiring scheme.

**Shipley.**—STREET LIGHTING.—The Highways Committee of the Urban District Council has obtained sanction to a scheme of improved electric lighting of main roads, embracing 242 lighting points, with two 300 candle-power lamps at each point. The cost is £5 per point and the charge will be ½d. per kWh consumed.

**Sidmouth.**—ADMINISTRATION.—The Urban District Council has decided that its gas and electricity undertakings shall be separately managed as from March 31st next, and will meet to consider the conditions under which the respective posts of gas manager and electricity manager are to be held.

**South Africa.**—UMTALI.—A ratepayers' meeting was held on September 22nd to consider the Town Council's proposal to borrow £53,000 for extending the electricity undertaking. Giving an account of the scheme, the Mayor said that a new power station, to be erected in the Darlington area near the railway, was estimated to cost £46,000, and the remainder of the amount was required to provide for a domestic and general power service and the provision of cooking and heating appliances to be sold to consumers on the instalment system. The revenue from the existing system, which is for lighting service alone, was approximately £7,000 per annum, and the minimum revenue from the proposed new power service to the railway workshops would be £2,700 per annum. The railways have agreed to take a power supply initially of 246 kW, with a consumption of 400,000 kWh per annum. The motion in favour of sanctioning the loan was carried.

**Special Orders.**—Application has been made to the Electricity Commissioners by Messrs. Crompton Parkinson, Ltd., for a Special Order authorising them to supply electricity in part of the rural district of Settle.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Blackburn Corporation to supply electricity in the township of Pleasington, and the Leicestershire and Warwickshire Electric Power Co. to supply in parts of the rural districts of Stratford-on-Avon and Warwick.

**South Shields.**—YEAR'S WORKING.—The report of the borough electrical engineer, Mr. J. Edgar, on the working of the Corporation electricity undertaking for the year ended March 31st last shows a total income of £116,396, as compared with £94,210 in the preceding year. Working expenses amounted to £49,311, as against £59,202, leaving a gross profit of £67,084 (£35,008), to which was added revenue from other sources making a total of £70,444 available. Capital charges

absorbed £45,831, and expenditure on works of a capital nature charged to revenue totalled £11,784, leaving a net surplus of £13,828, of which £7,000 was contributed to the borough fund and the remainder transferred to reserve. The capital expenditure during the year amounted to £59,988, the chief items being £21,479 for mains, and £17,334 for assisted wiring installations. The sales of electrical energy increased from 8,300,961 to 10,597,778 kWh, and the maximum load from 4,993 to 5,488 kW. The average price obtained per kWh fell from 2.72d. to 2.63d.

**Swansea.**—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend the main in Mansel Street to a sub-station to be erected at Pell Street, at an estimated cost of £1,505, and from the sub-station at the Brickworks, Fforestfach, to a sub-station to be erected at Ystrad Road, Fforestfach, at an estimated cost of £5,065.

**United States.**—HYDRO-ELECTRIC DEVELOPMENT.—The House of Representatives, by a vote of 166 votes to 233, recently accepted the Senate amendments to the Swing-Johnson Boulder Dam Bill. The Bill provides for harnessing the Colorado River at Black Canyon by the construction of a huge dam to provide for flood protection, irrigation, and power. The estimated cost of the dam is 165,000,000 dollars.—*Reuter* (Washington).

**Walton-on-Thames.**—HIRE OF APPARATUS.—The Urban District Council has, as a temporary measure, authorised the engineer and manager to purchase "bungalow" cookers, as and when required, and to let them out on hire-purchase at 7d. per week, and to allow such consumers to have kettles on hire for 1½d. per week.

**Western Australia.**—YEAR'S WORKING.—We have received a copy of the report on the working of the Government electricity supply undertaking (general manager: Mr. W. H. Taylor) covering the year ended June 30th last. The total income amounted to £246,804, and working expenses were £191,443, leaving a gross profit of £55,361. The figures for the preceding year were: Income, £221,769; working expenses, £171,964; gross profit, £49,805. After providing for interest charges there was a net surplus of £11,734, as compared with £7,465 in the preceding year. The sales of electrical energy increased from 54,362,141 to 60,932,360 kWh, and the maximum load from 15,800 to 17,300 kW. The installation of a 12,500-kW set was completed during the year and the set put into commission. The general manager states that the full boiler plant steaming capacity will be reached by December, 1929, and he recommends that early consideration be given to the duplication of the last boiler plant extension, and the installation of a further 12,500-kW turbo-generator, the latter to be in operation in June, 1930.

# Tramway and Railway Notes.

**Blackpool.**—TRANSPORT DEPÔT.—The Corporation is considering important proposals for the establishment of a central transport depôt, and for central workshops for the execution of necessary repairs, to include tramcars and motor 'buses. The scheme will be discussed at the January meeting of the Corporation.

**Colchester.**—ABANDONMENT OF TRAMWAYS.—The City Council has applied to the Ministry of Transport for an Order authorising it to abandon two tramway routes in the city.

**Heywood.**—TRACK RENEWAL.—At the last meeting of the Town Council it was reported that the Manchester Corporation would commence in January the reconstruction of the tramway track from Hopwood to the centre of the town, at an estimated cost of £17,000.

**Japan.**—RAILWAY ELECTRIFICATION.—It is understood that the Tobu Railway Co. has decided to electrify its Tojo single-track line between Ikebukuro and Yorii, a length of 46 miles, and proposes to double the track when the electrification of the existing line has been completed.

NEW ELECTRIC RAILWAY.—The Nankai Rapid Transit Electric Railway Co. is to construct an electric railway between Nankai-machi, Nishinariku, Osaka to Sano-machi, Sennangori, Osaka-fu, a distance of 20 miles.

**London.**—LEICESTER SQUARE STATION.—According to *The Times*, the Underground Railway proposes to obtain powers in the Parliamentary Bill to be promoted this session for the rebuilding of Leicester Square tube station. While no definite plans have been drawn up, it is probable that the new station will be designed on similar lines to the Piccadilly Circus station. The new station will be fitted with escalators.

**Manchester.**—EXPRESS TRAMWAY.—*The Times* reports that in view of the intention of the Corporation to build dwelling houses in great numbers on the recently-acquired Wythenshawe estate on the Cheshire side of the Mersey, the Tramways Committee has recommended the City Council to construct a sleeper-laid tramway track for a service of express tramcars extending the six miles from Manchester Town Hall to the border of Wythenshawe. The scheme will involve the construction of a new bridge over the Mersey at Northenden. Alderman Bowes, chairman of the Tramways Committee, states that it is estimated that in a very few years 100,000 people will be resident in Wythenshawe.

**Salford.**—OMNIBUS COMPETITION.—The City Council is to promote a Bill in Parliament prohibiting the running of motor-omnibuses along tramway routes.

**Western Australia.**—YEAR'S WORKING.—We have received from Mr. W. H. Taylor, general manager of the Government tramway undertaking, a copy of his report for the year ended June 30th last. The total revenue amounted to £318,957, as compared with £294,068 in the preceding year, and working expenses, including £21,000 for relaying of track, were £259,677, as against £241,280, leaving a gross profit of £59,280 (£52,788). Interest absorbed £48,799, and there was a net surplus of £10,481, as compared with £6,552 in 1926-27. The capital expended increased by £77,107 to £1,060,247, the chief items being £48,571 for extensions of certain routes, and £23,167 for part cost of 10 tramcars. The number of passengers carried increased from 30,541,079 to 32,657,626, the car miles run from 2,995,769 to 3,188,087, and the revenue per car mile from 23.56d. to 24.01d.

# Telegraph and Telephone Notes.

**"Beam" Radio Communication.**—SIMULTANEOUS TELEGRAPHY AND TELEPHONY.—Experiments with short-wave beam wireless with a view to proving that two or three telegraph messages and a telephone message may be sent in either direction at the same time over the same radio circuit are approaching completion. For a little more than six months they have been in progress between Bridgwater, in Somerset, and Montreal with one set of apparatus and one aerial, says *The Times*.

For the purposes of the experiments the Post Office has allowed the Marconi Company to use its beam station at Bridgwater, which was built by that company for the Post Office in 1926, and is the receiving station for the commercial telegraph service between England and Canada. The experiments have been quite independent of the ordinary service, and have not in any way impeded it.

**International Telephony.**—SWEDEN AND FINLAND.—The first section of the communication circuit between Sweden and Finland was recently inaugurated, when public conversation took place between Stockholm and the Aaland Islands, which are situated half-way between Sweden and Finland. Communication with the Finnish mainland will be ready for service before the end of the month. On December 16th telephone communication was inaugurated with Budapest.—*Reuter's Trade Service* (Stockholm).

The submarine cable from Stockholm, Sweden, to Helsingfors, Finland, is said to be the "largest" of its kind in the world.

**Rumania.**—AUTOMATIC TELEPHONY.—A proposal is on foot in Bucharest to install several new automatic telephone exchanges. One is already in use.

**The Telephone Service.**—LEICESTER AUTOMATIC SYSTEM.—The final change-over from manual to automatic working at Leicester took place at midnight on December 8th, the automatic exchanges in the area being Central (8,000 lines) and its three satellites at Syston, Western Park, and Wigston. These exchanges were opened in February last, when 1,200 of the subscribers served by the manual central exchange were transferred to the new automatic exchange and, at the same time, the manual exchanges in the satellite areas were closed and their subscribers changed over to the new system. The final change which has just been completed consisted of transferring over 5,000 subscribers to the new Central automatic exchange, and closing the old manual exchange. The new automatic equipments are Messrs. Siemens Brothers' No. 16 system, which firm also supplied the new manual trunk switchboard at the Central exchange.

HARPENDEN.—A new 5-position No. 10 c.b. manual switchboard built by Siemens Bros. & Co., Ltd., was opened on December 12th with 400 subscribers transferred from the old magneto exchange, which has been closed.

**Mexico.**—WIRELESS-TELEGRAPH STATION.—One of the last official acts of the former President Calles was to sign a decree granting to the A.E.G. a concession for the establishment of a wireless station in the vicinity of Mexico City. The cost of the equipment is put at 550,000 dollars, and is to be refunded to the A.E.G. by the National Telegraph Lines Organisation out of the surplus which traffic with other countries will yield. The station will provide a direct means of communication between Mexico and Europe and the whole of South America. A sum of 50,000 dollars will also be expended on the station buildings.

# Radio Notes.

**Battery Eliminators.**—BURNLEY.—Certain residents at Burnley have claimed compensation for alterations of their radio receiving apparatus which have been necessitated by the alteration of the municipal electricity supply system serving their houses. Some of the claims are to be repudiated, whilst others have been referred to a Committee.

**Germany.**—INSURANCE.—The Reichs-Rundfunk Gesellschaft has concluded arrangements with five insurance companies whereby free insurance against liability for accidents caused by wireless apparatus and aerials will be included, from January 1st, 1929, in the ordinary listening licences granted in Germany and the Free State of Danzig. The insurance will cover liability to third persons and their property, says *World-Radio*, to the amount of £5,000 and £1,250, respectively, the liability of tenants to landlords being included.

**International Broadcasting.**—HOLLAND.—Having been the first European country to establish a short-wave transmitter with a world-wide range to enable her to communicate with her colonies, Holland again took the lead on December 6th when the Hilversum (PCJJ) station commenced weekly schedule transmissions at such times and in various languages so arranged as to be received in distant countries under the most favourable conditions.

ENGLAND.—The British Broadcasting Corporation's short-wave Chelmsford (5 SW) Empire station is still regarded as experimental.

INDIA.—The United States and India were to be linked for an exchange of programmes for the first time on Boxing Day. Broadcasting between the two countries was to be attempted in the early morning of December 26th by station WGY at Schenectady (operating on 32 metres) and by the Calcutta station. An elaborate programme was prepared by the Indian Broadcasting Company.—*Reuter's* (Washington).

**Union de Radiophonie.**—LONDON MEETINGS.—The Commission of the Union Internationale de Radiophonie, specially concerned with programmes and administration, held four meetings in London during the week ended December 15th at the headquarters of the British Broadcasting Corporation, under the chairmanship of Mr. Oscar Czeija (Austria), the other delegates being Prof. Dr. Richtera (Austria), Mr. Hubert (Belgium), Mr. Pollock (France), Major Atkinson (Great Britain), Mr. Szoets (Hungary), and Mr. Chamiec (Poland). There were also present Dr. Sourek (Czecho-Slovakia), president of the Juridical Commission of the Union, and Mr. A. Burrows (secretary general of the Union). Amongst other business, draft forms were drawn up for uniform programme statistics and for the exchange of information concerning dramatic works suitable for broadcasting; special attention was given to the study of broadcasting to schools. Notwithstanding the fact that this "wireless parliament," with its own "council" and "cabinet," has no official rights, it is a representative body working for the good of international broadcasting. It represents 20 European countries and over 67 million listeners, of whom 33 millions are in Europe. Countries outside Europe are associate members, as the difficulty of meeting (the Union's headquarters are at Geneva, Switzerland) prevents them becoming full members.

# Contract Information.

**When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.**

## Contracts Open.

**Ashford.**—January 14th. Electricity Department. One heavy-oil engine to drive a 600-kW alternator, &c. (December 21st.)

**Bradford.**—January 1st. Education Committee. Electric lighting installations for various schools. City Architect, Town Hall.

**Brentwood.**—January 21st. Essex and Colchester Mental Hospital Committee. Wiring Brentwood Mental Hospital. (December 14th.)

**Edinburgh.**—January 14th. Electricity Supply Department. Boiler feed water de-aerating plant. (December 21st.)

January 18th. District Board of Control. Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

**Egypt.**—CAIRO.—January 31st. Ministry of the Interior. Diesel engine-driven d.c. generator set, d.c. rotary balancer and accessories for the Kafr El Zayat power station. (B.X. 4931.)*

**Falkirk.**—Falkirk and District Infirmary. Electric lighting installation at the new infirmary. Schedules, &c., from Mr. Duncan Kennedy, W.S., hon. secretary, Bank Street, Falkirk. (Deposit of one guinea.)

**Glass Houghton (Yorks.).**—January 14th. West Riding Education Committee. Electric lighting installation at Ashton Road Council school and caretaker's house. Specifications, &c., from Education Department, County Hall, Wakefield.

**India.**—NEW DELHI.—January 8th. Indian Stores Department. Three 12½-kW oil-engine-driven generator sets. (B.X. 4956.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

**Keighley.**—January 17th. Electricity Department. One water-tube boiler (30,000 lb. per hour) with mechanical stoker and superheater. (See this issue.)

**London.**—CENTRAL ELECTRICITY BOARD.—January 4th, 1929. 132,000-V transformers in connection with the South-East England Electricity Scheme, 1927. (November 2nd.)

ISLINGTON.—January 18th. Electricity Department. Materials for 12 months, including cables, meters, transformers, &c. (December 14th.)

LAMBETH.—January 3rd. Board of Guardians. Twelve months' supply of incandescent electric lamps. (December 21st.)

BETHNAL GREEN.—January 14th. Borough Council. Electric lighting and power installations and telephone installation for the public baths and washhouses at Old Ford Road. (December 21st.)

**Middlesbrough.**—December 31st. Education Committee. Installation of electric lighting in 10 Council schools and the Stockton Street Practical Instruction Centre. (December 14th.)

**New Zealand.**—WELLINGTON.—January 29th. Public Works Department. Single core, paper-insulated, lead-covered cable. (B.X. 4954.)*

March 18th. 110,000-V transformers (B.X. 4952)*, 11,000-V switchgear (B.X. 4953.)*

January 29th. 15 sets of earth leakage protection equipment. (B.X. 4950.)*

January 15th. Posts and Telegraph Department. Telephone cords. (B.X. 4847.)* Vitreous-enamel phase-indicating plates. (B.X. 4927.)*

February 12th. V.i.r. wire. (B.X. 4951.)*

February 19th. 120,000 galvanised steel spindles for insulators. (B.X. 4948.)*

February 28th. Whangarei Harbour Board. One 15-ton electrically-operated level luffing gantry crane. (A.X. 7263.)*

**Norton.**—January 14th. West Riding Education Committee. Electric lighting installation at the new school. Specifications, &c., from Education Department, County Hall, Wakefield.

**Rumania.**—January 10th. Ministry of Communications. 17,000 insulators, iron, steel, copper and bronze wire and 11,000 copper coupling rings. (A.X. 7 89.)*

**South Africa.** — JOHANNESBURG. — January 24th. South African Railways and Harbours. Two small d.c. crude-oil generating sets for Maguassi. (B.X. 4943.)*

February 14th. One 15-ton electrically-driven portal titan crane. (A.X. 7272.)*

South African Railways and Harbours. January 16th. Telegraph material. (A.X. 7301.)*

January 24th. Town Council. Electric cable. (B.X. 4977.)*

CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

**Turkey.**—ANGORA.—December 30th. Direction Générale des Chemins de Fer et des Ports d'Etat. Fuel economiser, d.c. motors, &c. (A.X. 7281.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

## Contracts Closed.

**Australia.**—SYDNEY.—Municipal Council.

Gasfilled metal-filament lamps.—British General Electric Co., Ltd. (£319); Lawrence & Hanson Electrical Co., Ltd. (2,299); Australian General Electric Co., Ltd. (£781).

A.c. consumers' electricity meters (£15,780).—Electricity Meter Manufacturing Co., Ltd. —*Tenders.*

**Bedford.**—Electricity Committee. Accepted:—

Feed water piping (£127).—Brightside Foundry & Engineering Co., Ltd.

Recorder and indicator outfit.—Cambridge Instrument Co., Ltd.

**Cannock.**—Urban Council. Accepted:—
Switchgear (£431).—English Electric Co., Ltd.

**Government Contracts.**—The following Government contracts were placed during November, 1928:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

W/T amplifiers.—Radio Instruments, Ltd.
Electric crane.—Stothert & Pitt, Ltd.
Electric forge.—Sir W. Arrol & Co., Ltd.
Dynamotors.—Small Electric Motors, Ltd.
Ceiling fans.—Revo Electric Co., Ltd.
Ship ventilating fans.—Electro Dynamic Construction Co., Ltd.; Mawdsleys, Ltd.; Veritys, Ltd.
Generating set.—English Electric Co., Ltd.
Generator.—Metropolitan-Vickers Electrical Co., Ltd.
Electric bakery plant.—General Electric Co., Ltd.
Quenching units and amplifiers.—H. W. Sullivan, Ltd.
Switches, sockets, &c.—Player & Mitchell, Ltd.; Hawkers, Ltd.; Edison Swan Electric Co., Ltd.; W. McGeoch and Co., Ltd.; Pinnacle Switchgear & Fuse Co.
Electric traveller.—Cowans, Sheldon & Co., Ltd.
Troughing and tiles.—Doulton & Co., Ltd.

WAR OFFICE.

Conduits and fittings.—Barton & Sons, Ltd.
Generating set.—Crossley Motors, Ltd.
Laryngaphone head sets.—Telephone Mfg. Co., Ltd.
Wireless telegraph sets.—Radio Instruments, Ltd.

AIR MINISTRY.

Accumulators.—Fuller Accumulator Co. (1926), Ltd.
Motor-generators.—W. Mackie Co., Ltd.
Magnetometers.—Cambridge Instrument Co., Ltd.
Maintenance of reaction apparatus.—Reid & Sigrist, Ltd.
Switches.—Pyne Mfg. Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; Siemens Bros. and Co., Ltd.; Telephone Mfg. Co., Ltd.
Protective apparatus.—International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.
Battery stores.—Premier Accumulator Co. (1921), Ltd.; Tudor Accumulator Co., Ltd.
Bells.—T. Watson.
Cable.—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Telegraph Construction and Maintenance Co., Ltd.; Union Cable Co., Ltd.
Joint box castings.—General Foundry & Engineering Co., Ltd.; United Steel Co.'s, Ltd. (T. Butlin & Co.).
Loading coils.—Standard Telephones & Cables, Ltd.
Cords for telephones.—British Insulated Cables, Ltd.; Reliance Electrical Wire Co., Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe and Firebrick Co., Ltd.; J. Oakes & Co. (Riddings Collieries), Ltd.; Oates & Green, Ltd.; J. Place and Sons, Ltd.; Standard Brick & Terra Cotta Co., Ltd.; Sutton & Co. (Overseal), Ltd.; Swansea Potteries, Ltd.
Insulators.—J. Carder & Sons; T. De la Rue & Co., Ltd.; Litholite Insulators, Ltd.
Telegraphic ironwork.—D. Willetts, Ltd.
Thermionic valves.—Standard Telephones & Cables, Ltd.
Batteries, Swansea Telephone Exchange.—Pritchett and Gold & E.P.S. Co., Ltd.
Electric lifts, Salford Auto Telephone Exchange and Newcastle-on-Tyne Central Telephone Exchange.—Keighley Electrical Engineering Co., Ltd.
Telephone exchange equipment.—Buxton: Standard Telephones & Cables, Ltd. Harrogate: General Electric Co., Ltd. Sub-contractors: D.P. Battery Co., Ltd., for battery work. Greenwich: General Electric Co., Ltd. Canterbury: Ericsson Telephones, Ltd.
Telephone repeater station power plant.—Edinburgh: Metropolitan-Vickers Electrical Co., Ltd. Port Erin (Isle of Man): General Electric Co., Ltd.
Repeater station equipment, Port Erin (Isle of Man), Blackpool and Belfast.—General Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Alarm apparatus.—Siemens & General Electric Railway Signal Co., Ltd.
Battery materials.—Le Carbone.
Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Ceiling fans.—Crompton Parkinson, Ltd.
Electric haulers.—Beckett & Anderson, Ltd.
Static transformer.—English Electric Co., Ltd.
Steel poles.—British Mannesmann Tube Co., Ltd.
Street lighting fittings.—Revo Electric Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.; J. Spencer, Ltd.
Telephone equipment.—Standard Telephones & Cables, Ltd.
Train lighting material.—J. Stone & Co., Ltd.

H.M. OFFICE OF WORKS.

Cable.—T. Clarke & Co., Ltd.
Accumulator, Manchester City Telephone Exchange.—Hydraulic Engineering Co., Ltd.
Renewal of battery plates, National Physical Laboratory.—Tudor Accumulator Co., Ltd.

**Guildford.**—Electricity Committee. Accepted:—
V.i.r. flexible cord cables.—Craigpark Electric Cable Co.

**London.**—STEPNEY.—Electric Supply Committee.
E.h.p. switchgear for Limehouse generating station.

| | |
|---|---|
| A. REYROLLE & Co., LTD. (Recommended.) ... | £10,421 |
| Ferguson, Pailin, Ltd. ... ... ... ... ... | 10,798 |
| British Thomson-Houston Co., Ltd. ... ... | 11,226 |
| English Electric Co., Ltd. ... ... ... ... | 11,510 |
| Metropolitan-Vickers Electrical Co., Ltd. ... | 11,933 |

Steel frame station building, coal bunkers, &c., for the Limehouse generating station extensions—
Ed. Wood & Co., Ltd. (Recommended.) ... £26,995

ISLINGTON.—Lighting Committee. Recommended:—
12 steel-tube lamp columns (£300).—Hardy & Padmore, Ltd.
General Purposes Committee.
Two sets of batteries for internal telephone system.—Chloride Electrical Storage Co., Ltd. (Recommended.)

WAR OFFICE.

Bell brackets and bracket cases.—Edison Swan Electric Co., Ltd.

SHOREDITCH.—Housing Committee. Recommended:—
Electric lighting installation at 155 tenements at Bleydons Dwellings (£595).—Elliston, Evans & Jackson, Ltd.

**Morecambe.**—Electricity Committee. Accepted:—
400-kVA transformer (£197).—Ferranti, Ltd.

**Newcastle.**—Tramways Committee. Accepted:—
Tramway rails and fishplates (£1,323).—Bolckow, Vaughan and Co., Ltd.

**New Zealand.**—WELLINGTON.—Posts and Telegraph Department.
Cable.—(19¼ miles), Pirelli-General Cable Works, Ltd.; (7½ miles), Enfield Cable Works, Ltd.; (3 miles), Union Cable Co., Ltd.; (3 miles), British Insulated Cables, Ltd.; (8 miles), Standard Telephones and Cables, Ltd.
V.i.r. wire (£3,376).—Callender's Cable and Construction Co., Ltd. —*New Zealand Engineer.*

**Paignton.**—Public Grounds Committee. Accepted:—
Electric lighting installation for the pavilion and entrances at Queen's Park.—Paignton Electric Light and Power Co., Ltd.

**Preston.**—Town Council. Accepted:—
Transformer plant for the Blackpool additional supply scheme (£35,100).—English Electric Co., Ltd.

**Seaham Harbour.** — Housing Committee. Recommended:—
Wiring 40 houses on the Carr House Estate (£188).—Harrison Bros.

**Stoke-on-Trent.**—Electricity Committee. Accepted:—
Cooling tower at power station (£8,267).—Davenport Engineering Co., Ltd.

**Walton-on-Thames.**—Urban Council. Accepted:—
Four transformers for sub-stations (£647).—Hackbridge Electric Construction Co., Ltd.
Short lengths of cable for the sub-stations.—Pirelli-General Cable Works, Ltd.

# Forthcoming Events.

**Royal Institution of Great Britain.**—Saturday, December 29th, Tuesday, January 1st, and Thursday, January 3rd. 21, Albemarle Street, W. 3 p.m. "Sound Waves and Their Uses." Mr. A. Wood.

**Association of Supervising Electrical Engineers.**—Tuesday, January 1st. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. "Power Factor Correction." Mr. C. S. Buyers.

**Television Society.**—Tuesday, January 1st. Engineers' Club, Coventry Street, W. 8 p.m. "Scanning Methods Used in Television." Mr. J. C. Rennie.

**Institution of Heating and Ventilating Engineers.**—Wednesday, January 2nd. Caxton Hall, S.W. 7 p.m. "Economic Application of Electricity to Low-Temperature Heating Purposes." Mr. G. Wilkinson.

**Institution of Electrical Engineers (Wireless Section).**—Wednesday, January 2nd. Institution, London, W.C. 6 p.m. "The Design of Transmitting Aerials for Broadcasting Stations." Messrs. P. P. and T. L. Eckersley and H. L. Kirke.

**(Meter and Instrument Section).**—Friday, January 4th. Institution, London, W.C. 7 p.m. "Precautions in the use of Standard Instruments." Mr. H. Lawes.

**Institution of Mechanical Engineers.—Informal Meeting.**—Friday, January 4th. Institution, Storey's Gate, S.W. 7 p.m. "The Engineer Salesman Abroad." Major A. W. Farrer.

# Notes.

### Sydney Bribery Charges.

It was stated last week that Messrs. Babcock & Wilcox, Ltd., had been granted a *rule nisi* restraining the Sydney magistrates from proceeding with the conviction of the company as reported in our issue of December 14th. It will be recalled that the company was fined £1,000 and ordered to pay the Sydney City Council £10,600 within six months in connection with the charges of bribery brought against it following the conviction of Mr. S. Y. Maling, formerly deputy general manager of the City Electricity Department.

In applying for the rule counsel for the company said that no evidence had been produced to show that the company was aware of the payment of the alleged bribe and that certain evidence was wrongfully admitted by the Sydney magistrates.

In the House of Commons on December 19th, Mr. T. Henderson asked whether in view of the proceedings against them Messrs. Babcock & Wilcox, Ltd., would be removed from the Admiralty list. Lt.-Col. Headlam replied that he had had no official information regarding the matter, but as he had been told that the company was applying for a stay of proceedings any such action as that suggested would be premature.

### Electricity in Coal Mining.

In a paper on "The Economics of Coal Production and Distribution," by Mr. G. Raw, B.Sc., read at the recent Conference of the Institute of Fuel, the following comments are made on the use of electricity in the coal mining industry:—

Of the power used below ground, modern legislation and practice confines the mining engineer to that of electricity and compressed air. Compressed air is so notoriously expensive and inefficient that its use is seldom justified except where the use of electricity is precluded on the grounds of safety. The modern air compressor leaves little to be desired in the direction of efficiency as a unit, but the overall efficiency of a compressed-air plant is so low that little more need be said than that while compressed air power is greatly preferable to that of the employment of animals, it should not generally be used where electricity may be used in its place. The growth of the use of electrical power increases steadily year by year. In the year 1918 the mines of Britain were using one million h.p. of electrical power, and since then the figure has been increased by three-quarters of a million. Although only 8.5 per cent. of this power is used for the winding of coal, electric winding has been more than trebled since 1920. It has been generally realised that whereas pumping, haulage, screening plant, &c., are undoubtedly more efficiently worked electrically, electrification becomes debatable when applied to the heavier winding, ventilating and air compressing units. A deciding factor is the relative cost of the available steam and electric power supply. The great advance made in the use of pulverised-fuel and in the design of boiler plant for the consumption of low-grade fuel promises to delay indefinitely the realisation of the electrical engineer's dream of steamless industry, and, incidentally, those grandiose national schemes which would confine the generating of power to centrally situated super-power stations.

### A Diesel-Electric Dredger.

Messrs. J. & K. Smit's shipyard, Kinderdijk, Holland, is building a large dredger for the Argentine Government, says the *Motor Ship*. The cutter on the end of the suction main can be replaced by a trailing bucket. The dredger will be one of the largest of its class in the world and Diesel-electric drive will be employed for all purposes. The total Diesel power will be 3,800 b.h.p.; four eight-cylinder four-stroke airless-injection engines of Smit-M.A.N. type, besides some smaller engines for auxiliary purposes, are being installed.

### Appointments Vacant.

Electrical engineer (£600) and mechanical engineer (£600) for the Government of Nigeria P.W.D. Electrical Branch. Mains assistant (£200) for the Borough of Stoke Newington Electricity Department. Plumber-jointer for the Nelson Corporation Electricity Department. Assistant (male) in the Borough of Leigh Electricity Department Showroom (£4). Consumers' clerk (£77) for the Fulham Corporation Electricity Department. Temporary 3rd class mechanical engineering draughtsman and temporary 3rd class electrical engineering draughtsman for the Metropolitan Asylums Board. (See our advertisement pages to-day.)

### Fatalities.

Oswald Morris, a collier, and his wife, of Tonteg, Pontypridd (Glam.) received fatal electric shocks on December 19th. Morris was changing an aerial wire from the front to the back of his house. To do so, he had passed it over the roof, above which ran the electric light cable at 230 V. When the wire was raised it snapped and touched the cable, killing him instantly. His wife ran to his assistance and, also receiving the full force of the current, fell dead. Their son, aged 16, went to their assistance, but escaped with a shock.

An inquest was held at Hull on December 18th on Doris Laverick, aged 8, who, as recorded in our last issue, received a fatal electric shock whilst undergoing an X-ray examination at the Hull Royal Infirmary. Dr. Bannen, radiologist, said it was clear to him that what had happened was that, whether the nurse was warned or not as to the danger, she went to the dangerous side of the table when she crossed over to another part of the room. She did that while the high-voltage circuit was in operation, and placed herself unwittingly in what was an ideal position, even if she did not touch the wires but only went near to them, to form a complete electric circuit, which even if of low voltage, would be sufficient to kill the child. He said there was no efficient method for insulating the leads. The coroner said that the question of the admission to the X-ray room of inexperienced nurses was one which might, and probably would, be considered by the infirmary authorities in the future. The jury returned a verdict of "Accidental death."

### Electricity and the Tides.

"Electricity and the Tides" was the subject of an address delivered by Mr. S. Gordon Monk, head of the electrical engineering department of the Plymouth Technical College, to members of the Plymouth Rotary Club on December 14th. He said the principle of harnessing the power in the tides was to impound the water at high tide, and make use of it when the tide fell below the basin. Referring to the Severn scheme, Mr. Monk said that a 30-ft. fall over an area of 20 sq. miles would produce 100,000 kW continuously. It was estimated that 80,000 kW could be provided. In Hopewell, New Brunswick, Canada, it was hoped to generate 90,000 h.p., ultimately extending to 200,000 h.p. By far the most interesting scheme was the Wash scheme, for dividing the Wash into two huge basins, which was to be begun with a partial scheme involving the construction of a 17½-mile dam, with an eight-mile dividing wall. The full basin would cover 22,500 acres, and the empty basin 9,000 acres. It was hoped to provide a generating station with a capacity of 300,000 h.p. The cost was estimated at £6,500,000. The capital had already been guaranteed, and the operating costs would be very small. What could be done on the Wash could be done elsewhere; indeed, the possibilities in the Plymouth area were enormous. There was talk of damming the Laira lake; if that were done the tides could be harnessed and power generated at the same time, and an additional advantage would be that the water would be kept at a fairly even level and the lake improved from a boating point of view.

### A "Reliability Trial" in Australia.

The Metropolitan-Vickers Electrical Co., Ltd., has forwarded to us some remarkable statistics for the year ended June 30th, 1928, for the Yallourn Station of the Victoria State Electricity Commission. The station is now equipped with six Metro-Vick 12,500-kW turbo sets, but during the period in question only five were installed. The maximum demand on the station varied from 58,000 to 67,000 kW, the total capacity of the generating sets being 62,500 kW. The running hours of the five sets totalled 33,179, which gives an average of 6,635 hours per machine. The station load factor, recorded monthly, varied from 53.5 per cent. to 62.8 per cent., the monthly average being 58.7 per cent. The machine load factor varied from 71.8 per cent. to 77.8 per cent., and averaged 75.3 per cent. During the year previous to that to which the above figures apply, the load conditions were equally severe. It is pointed out that this really means that every one of the five Metro-Vick sets—the only sets in the station—has been in practically continuous service for two years.

### World Engineering Congress in Japan, 1929.

With reference to the Congress which is being held at Tokio between October 29th and November 22nd, 1929, by the Kogakkai, or Engineering Society of Japan, and supported by the Japanese Government, a conference of representatives of twenty-three institutions and societies was held at the Institution of Civil Engineers recently to consider the best means by which British representation at the Congress could be organised. As a result, "The British Committee on the World Engineering Congress in Japan" was formed, having its Secretariat and place of meeting provided by the Institution of Civil Engineers. The Committee has as its objects (*a*) The organisation of a party of British engineers to attend the World Engineering Congress at Tokio, and (*b*) the securing of a number of papers on engineering subjects for presentation at that Congress.

In order to examine in detail the means by which the objects of the Committee may be furthered, a small Executive Committee consisting of the following has been formed: Sir Brodie Henderson (chairman), Mr. R. W. Allen, Sir John Biles, Sir Alexander Gibb, Professor P. A. Hillhouse, Mr. Archibald Page, Mr. E. F. C. Trench.

The Congress will be the first of its kind held in Japan, and it is evident that the Japanese, with their usual energy, are making every effort to render the Congress worthy of the progress achieved in that country. It is the wish of the Committee to awaken the interest and enlist the support of all engineers, so as to ensure adequate British representation at the Congress by the presence of a large party of delegates and by the presentation of a number of papers.

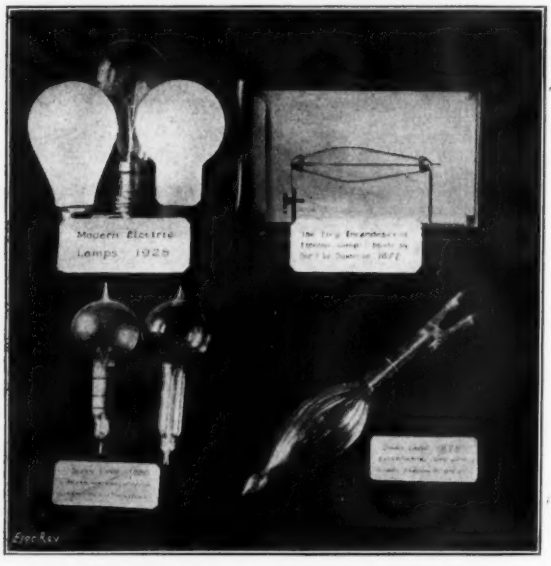
### The Suggestion Box.

During the month of November, 434 "Suggestions" were submitted by the railway, 'bus, and tramway employés of the London Underground Railways; of these, 32 are to be adopted, including the following: Improvement to oil pumps, Lots Road power house; improvement to current rail of 40-ton crane, Lots Road power house; improvement to exhaust tube flanges (omnibuses); improvement to hinged trolley heads (tramways).

# Institution Notes.

## Institution of Electrical Engineers.

JUBILEE OF THE CARBON LAMP.—Commencing his lecture on Sir Joseph Swan's Electrical Work on Thursday last week, Mr. James Swinburne, F.R.S., remarked that he was employed by Mr. Swan in 1881, and was in Newcastle when Swan was developing the incandescent lamp in the late seventies. The earliest mention of the incandescent lamp that he knew of was in the *Courier Belge* in 1836; it referred to safety lamps for miners, and pointed out that the solution was a carbon conductor electrically heated in a vacuum. Swan began experimenting soon after he had heard a lecture by Staite, in




Swan lamps of 1877, 1878, and 1880.—*P. & A. Photo.*

**Ancient and Modern Incandescent Lamps.**

1845, but was unable to succeed with carbonised paper strips owing to the lack of a good air-pump; he made carbon lamps between 1855 and 1860, but they soon burned out. After the invention of the Sprengel pump, with the aid of C. H. Stearn and F. Topham he resumed his experiments, overcoming many technical difficulties; he got his first good results with thin straight rods; this lamp was exhibited in 1878, and attracted a great deal of attention. He felt that there was little patentable in his work, but early in 1880 he patented running the lamp during exhaustion, to get the gas out. In the same year he used parchmentised paper, and he made nearly homogeneous thread by treating cotton with sulphuric acid, washing and drying it, and drawing it through dies. This was the foundation of homogeneous or amyloid material which came into universal use. The joints were improved by heating under auiline; he found benzole better. By the end of 1881 he had perfected the carbon lamp for up to 60 volts, and soon got the carbons fine enough for 100 volts. In 1884 Swan worked out the squirting process. His brother Alfred invented the vitrite cap.

In 1879 Edison was working on platinum lamps, but when Swan's lamp was known it seemed likely that carbon would be the solution of the lamp problem. Edison then took out a patent for a lamp with a carbon filament in a vacuum, sealed into glass. The filament was to be made from tar-putty, but no one could make such a filament, and there was no advance in lamp making in Edison's famous patent. Edison thought he had invented parallel distribution on 100 volts; but St. George Lane-Fox more than a year before Edison had taken out a patent in which he explained 100-volt parallel distribution, and used secondary batteries, and he must have the credit for having propounded completely, with luminous clearness, the parallel distribution. Edison went on with carbon lamps, and soon succeeded; but, said Mr. Swinburne, he was after Swan all the time.

Col. R. E. CROMPTON proposed, and Mr. K. SWAN seconded, a vote of thanks to the lecturer.

An interesting collection of early carbon lamps, including Swan's first successful lamp of 1877, was on view.

METER AND INSTRUMENT SECTION.—The first Committee of the recently formed Meter and Instrument Section of the Institution has now been appointed. Its constitution is as follows: Chairman, Mr. G. D. Malcolm; the President, I.E.E. (ex-officio); the Chairman of the Papers Committee, I.E.E. (ex-officio); member of Council, Mr. C. C. Paterson, O.B.E.; ordinary members, Mr. W. E. C. Alliss, Mr. F. A. East, Mr. C. H. W. Gerhardi, Mr. J. T. Haynes, Mr. E. W. Hill, Mr. R. G. Isaacs, Mr. F. C. Knowles, Mr. W. Lawson, Mr. C. W. Marshall, Mr. A. Middleton, Mr. William Phillips, and Mr. G. F. Shotter.

WESTERN CENTRE.—The annual dinner of the Western Centre will be held at the Grand Hotel, Bristol, on Monday, January 14th, 1929. Ladies are again invited, as at Cardiff last year.

## Institution of Heating and Ventilating Engineers.

An election for membership to the Institution will take place at an early date, and intending applicants should send in their proposal forms to the secretary at 12, Russell Square, London, W.C.1, not later than January 10th.

# Our Personal Column.

**Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.**

The triennial award of the Coopers Hill War Memorial prize and medal, which fell in 1928 to the Institution of Electrical Engineers, has been made by the Council to Mr. W. PHŒNIX, A.M.I.E.E., for his paper on "Electricity in Agriculture, with special reference to Electro-Culture."

Mr. F. S. HAYBURN has been appointed deputy managing director of the Marconi International Marine Communication Co., Ltd. He will also carry out the functions of general manager. The Rt. Hon. F. G. Kellaway is managing director. Mr. Hayburn has been associated with the company for over 24 years. He was appointed assistant general manager in 1922, manager in 1925, and general manager in 1927. Mr. Hayburn is vice-president of the Comité International Radio-maritime, which was formed this year to co-ordinate the services of marine wireless companies throughout the world for the mutual benefit of the companies themselves and of their shipowner clients. Mr. Hayburn, who is 50 years of age, spent ten years in the telegraph branch of the Post Office, and was the first British Government telegraph engineer in the Orange Free State after the South African war. He joined the Marconi Marine company in 1904, and from 1906 to 1920 was with the associated company, the Société Anonyme Internationale de Télégraphie sans Fil, Brussels, of which he became traffic manager. During the war, when the Belgian company's business was conducted from London, Mr. Hayburn was in control of neutral ships fitted with wireless. He returned to the English company in 1920, and acted as assistant to the late general manager, Mr. W. W. Bradfield, C.B.E., from June, 1921.

According to the *Yorkshire Post*, the Radiological Society of America has awarded the gold medal for merit in X-ray science to Dr. Bouwers, of Philips' Lamps research laboratories. Dr. Bouwers is the inventor of the Metalix X-ray tube. He is shortly visiting the United States to lecture to American radiologists.

*The Times* states that Mr. F. A. SZARVASY has resigned from the boards of the International Holding and Hydro-Electric Companies, the reason being that the control of these two companies has entirely shifted to Brussels into the hands of the Société Générale de Belgique, and that the advisory committee which was established while Captain Loewenstein was alive, and consisted of himself, Major Pam, and Mr. Szarvasy, has been dissolved. The *Financial Times* states that Major Albert Pam has not resigned his position as a director of the companies.

Blackpool Council, at its meeting on December 19th, approved a recommendation of the Salaries Committee that the suggested increase in the salary of Mr. CHARLES FURNESS, the electrical engineer and manager, from £1,250 to £1,600 per year be deferred until the transport policy of the Corporation is finally decided.

Mr. J. T. MOULD, of the Igranic Electric Co., Ltd., has been elected chairman of the Radio Manufacturers' Association, and Mr. R. B. WEAVER, of the General Electric Co., Ltd., vice-chairman.

Major H. DERBY, who has relinquished the position of general manager of the Aldershot and District Traction Co., which he has held for six years, has been presented by the employés with a clock and a gold wristlet watch, and by the drivers and conductors with an illuminated address. Mrs. Derby was given a pair of silver vases.

Mr. ARTHUR TEASDALE, for many years electrician to the Westhoughton Coal & Cannel Co., near Wigan, has retired after 46 years' service, and has been presented with a gold watch.

We are very pleased to be able to inform our readers that Mr. A. P. WOOD, managing director of the Lancashire Dynamo

and Motor Co., Ltd., is already benefiting in health from the complete rest that he is taking. He hopes to be able to meet his business friends again comparatively early in the New Year.

For the vacant managership of the Edinburgh Corporation Transport Department, the Transport Committee on December 19th recommended Mr. F. A. FITZPAYNE, M.I.E.E., who for eight years has been deputy manager. Mr. Fitzpayne received his early training at Faraday House, and also had electrical and mechanical engineering experience at Southend-on-Sea, in connection with the installation of the tramways and lighting system. Later he held appointments in London and Manchester, and 22 years ago was appointed manager of the Leith tramways. When the Edinburgh-Leith amalgamation took place Mr. Fitzpayne was appointed deputy manager in Edinburgh, and, along with Mr. Pilcher, was responsible for the conversion of the cable system to electric traction.

Mr. T. L. MILLER, consulting engineer of Liverpool, to whose retirement we have already referred, advises us that he has transferred his practice, &c., to Mr. A. B. MALLINSON, M.I.Mech.E., M.I.E.E., of Worsley Street, Salford, and St. James' House, Brazennose Street, Manchester. Mr. Miller's Liverpool office will be closed and Mr. Mallinson will deal with matters from Manchester, where he has been in practice as a consultant for 17 years.

**Obituary.**—MR. J. M. JOLLY.—Mr. J. M. Jolly passed away suddenly on December 10th as the result of an operation. He was managing director of the Skefko Ball Bearing Co., Ltd., for four years, and had previously held a managerial position in the British Metals Corporation. Before the war Mr. Jolly represented the interests of the A.E.G. (Berlin) in Australia, and had previously been associated with Messrs. Noyes Bros., of Sydney. During the war he was in charge of the National Cartridge and Repair Factory at Newport, Mon. Mr. Jolly was only 48 years of age.

MR. W. DUXBURY.—The death occurred recently in Australia, at the age of 75 years, of Mr. Wm. Duxbury, who was for 25 years manager of the Melbourne Tramway and Omnibus Co.

MR. C. O. CLARK.—The death occurred on December 15th, at the age of 53 years, of Mr. C. O. Clark, M.I.E.E., who carried on business at Dover and Deal, with branches in London and Horsmonden. He established the East Kent Electricity Works in Mill Road, Deal, seven years ago. He was for seven years with Crompton & Co., Ltd.

Mr. L. ANDREW.—We regret to record the death, which occurred on December 22nd at his residence at Brightstowe, Hale, Cheshire, of Mr. Llewellyn Andrew, A.M.I.E.E., principal of the firm of L. Andrew & Co., of Manchester. He leaves a widow. The business will be carried on as usual under the old style, and Mr. W. D. Snape, who has been actively connected with it since its establishment in 1893, will continue as manager.

**Wills.**—Sir ALEXANDER B. W. KENNEDY, F.R.S., who passed away in November, left £90,103 net and £90,909 gross personalty.

Mr. C. G. CONRADI, of Electromobile (Leeds), Ltd., left £1,565 net and £2,153 gross personalty.

Mr. C. J. JEWELL, late general manager of the Norwich Electric Tramways, left £2,558 gross and £1,549 net personalty.

# Financial Section.

**New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.**

## New Companies Registered.

**Oliver Electrical Supplies Co., Ltd.**—Private company. Registered December 17th. Capital, £100 in £1 shares. Objects:—To carry on the business of electricians, engineers, manufacturers of, and dealers in electrical apparatus and appliances, &c. The directors are:—F. E. Gordon, 10, North Avenue, W. Ealing, W.; J. A. Wilkinson, 5, Carlton Road, Stroud Green, N. Registered office: 10, Bolt Court, Fleet Street, E.C.4.

**Celestion, Ltd.**—Registered as a public company December 17th. Capital, £400,000 in 250,000 cumulative participating preferred ordinary shares of £1 each and 600,000 deferred ordinary shares of 5s. each. Objects:—To acquire the business carried on by C. French as the Celestion Radio Co., including certain trade marks, so far as it relates to the British Empire, to enter into two agreements (1) with the said vendor and E. H. B. Snoadon for the acquisition of the assets and business, and (2) with C. French for his appointment as managing director, and to carry on the business of manufacturers, importers, exporters, and factors of electrical and wireless apparatus of all kinds, gramophones, &c. The subscribers (each with one cumulative participating preferred ordinary share) are:—R. W. R. Allen, 426, Salisbury House, London Wall, E.C.2, solicitor; O. V. Baldwin, 57, Lordship Park, Stoke Newington, N.16, solicitor; and five others. Registered office: Celestion Works, London Road, Kingston-on-Thames.

**Burgoyne Wireless, Ltd.**—Private company. Registered December 14th. Capital, £6,000 in £1 shares. Objects: To adopt an agreement with E. H. Hine and to carry on the business of manufacturers of and dealers in wireless sets, loud speakers, parts, &c. The subscribers (each with one share) are:—C. M. Stoner, 26, Palmerston Road, Wimbledon, S.W.19, clerk; J. R. H. H. Orbell, 70, Watcombe Road, South Norwood, S.E.25, clerk. The first directors are:—E. D. Hine (permanent) and F. J. Chambers. Registered office: 36a, York Road, King's Cross, N.

**Lisbellaw Electric Lighting Co., Ltd.**—Registered in Belfast December 3rd. Private company. Capital, £1,000 in £1 shares. Objects: To carry on the business of an electricity company in all its branches. The first directors are:—F. R. Kinning, Lisbellaw, commercial traveller; W. G. Eadie, Lisbellaw, woollen manufacturer; W. T. Brownlee, Lisbellaw, merchant; R. L. White, Lisbellaw, council clerk; G. H. Bleakley, Lisbellaw, teacher. Secretary: J. H. Adamson. Registered office: Lisbellaw.

**Einstein's Electro-Chemical Process, Ltd.**—Registered as a public company December 15th. Capital: £500,000 in 250,000 8 per cent. participating preference shares of £1 each and 1,250,000 ordinary shares of 4s. each. Objects: To acquire from V. I. Einstein the process invented by him for the metallising of materials by electrochemical action, to carry on the business of electricians, mechanical engineers, electroplaters, manufacturers of and dealers in chemicals and drugs, &c. The subscribers (each with one preference share) are:—E. Fendrek, 51, Elms Road, S.W.4, cashier; L. V. Laming, 190, Princes Avenue, W.13, solicitor's clerk; and five others. Registered office: 16, St. Helen's Place, E.C.3.

**Donarelli Phono-Electron, Ltd.** — Private company. Registered December 14th. Capital, £25,000 in 1s. shares. Objects: To acquire and turn to account an invention known as the "Fono-electron Italico," to adopt an agreement with U. Donarelli, A. Cillario, and F. T. Strong, and to carry on the business of manufacturers, factors, agents and licensees of gramophone records, gramophones and musical instruments, electrical, radio and television apparatus, &c. The subscribers (each with one share) are:—H. Pettitt, L. A. Ellwood, and L. A. Stewart, all of 18, Austin Friars, E.C.2. Solicitors: Slaughter & May, 18, Austin Friars, E.C.

**Jerusalem Electric and Public Service Corporation, Ltd.**—Particulars of this company were filed on December 10th, pursuant to Section 274 of the Companies (Consolidation) Act. The company was incorporated in Palestine. The British address is 66, Queen Street, E.C.4, where T. K. Anderson is authorised to accept service of process and notices on behalf of the company. The directors are:—W. Shearer, "Inglewood," Chislehurst; Sir John H. B. Noble, "Ardkinglas," Inverary; Major Sir Archibald B. Boyd-Carpenter, M.P., River House, Walton-on-Thames; L. L. Le Bouvier, Ottoman Bank, Palestine; and J. G. B. Stone, Muir House, Broadwater, Worthing. A certified copy of the memorandum and articles of association has been sent to Jerusalem for certification.

## Official Returns of Electrical Companies.

**James Gordon & Co., Ltd.**—Satisfaction to the extent of £1,800 on November 21st of debenture dated March 7th, 1928, securing £7,000.

**Turner, Atherton & Co., Ltd.**—Capital, £140,116 in 62,861 preference and 77,255 ordinary shares of £1 each. Return dated August 17th, 1928. 49,172 preference and 51,597 ordinary shares taken up. £26,487 paid on 19,228 preference and 7,259 ordinary shares. £74,282 considered as paid on the remainder. Mortgages and charges, nil.

**Ebonestos Insulators, Ltd.**—Satisfaction in full on November 20th, 1928, of debenture dated October 1st, 1924, securing £5,000.

**E. A. Langrish & Co., Ltd.**—Capital, £15,000 in 7,500 preference and 7,500 ordinary shares of £1 each. Return dated November 8th, 1928. 5,965 preference and 5,800 ordinary shares taken up. £11,235 paid, leaving £530 in arrears. Mortgages and charges, nil.

**Holophane, Ltd.**—Capital, £100,000 in £1 shares. Return dated October 12th, 1928. All shares taken up. £7 paid. £99,993 considered as paid. Mortgages and charges, nil.

**Ramsbury Electric Supply Co., Ltd.**—Capital, £4,000 in 2,000 preference and 2,000 ordinary shares of £1 each. Return dated July 6th, 1928. 1,532 preference and 1,988 ordinary shares taken up. £2,320 paid on 1,232 preference and 1,088 ordinary shares. £1,200 considered as paid on 300 preference and 900 ordinary shares. Mortgages and charges, nil.

**Underwood (Manchester), Ltd.**—Satisfaction to the extent of £1,500 on November 30th, 1928, of "A" debentures authorised April 4th, 1927, securing £7,400.

**Water Heaters, Ltd.**—W. M. Campbell, 56, Victoria Street, S.W.1, ceased to act as receiver or manager on December 6th, 1928.

**Bailey & Incledon, Ltd.**—Particulars filed of £2,000 debentures authorised November 2nd, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

**Hartley Engineering Co., Ltd.**—Issue on October 10th, 1928, of £200 debentures, part of a series already registered.

**G. S. Hawker, Ltd.**—Satisfaction in full on May 2nd, 1928, of mortgage dated December 31st, 1925, securing £900. (Notice filed December 13th.)

**Park Wireless, Ltd.**—Satisfaction in full on December 10th, of debenture dated November 20th, 1928, securing £100.

**Bower Electric (1926), Ltd.**—Satisfaction in full on December 11th, 1928, of debentures dated February 22nd, 1926, securing £1,500.

# City Notes.

### Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Alphean Wireless, Ltd.
Automobile Electrical Repairers, Ltd.
British Glow Lamp and Valve Co., Ltd.
Bucks. Electrical Wire and Engineering Co., Ltd.
Domestic and General Electrical Co., Ltd.
Ebonite Manufacturing Co., Ltd.
Essex Radio (Ilford), Ltd.
London and South Wales Electrical Engineers, Ltd.
Luen Electrical Supplies, Ltd.
Perfecta Electric, Ltd.
Radio Experimental Co., Ltd.
Rubber Cables, Ltd.
Spa Radio Co., Ltd.
Vinco Wireless Co., Ltd.
Wireless Experts, Ltd.

### John Shaw & Sons, Wolverhampton, Ltd.

In the course of his speech at the recent annual meeting, the chairman (Mr. G. Terrell) said that the electrical department failed to come up to expectations, and the year's trading resulted in a loss. It was satisfactory to know, however, that the sales during the first five months of this year were well above those of the corresponding period of last year. If it continued in this way the department should show a profit. Their South American trade had caused them anxiety, but they had been able to cover some proportion of the risk of bad debts with the Export Credits Department of the Department of Overseas Trade. They had exercised great caution in dealing with that trade, and the result was a loss. During the first five months of the year this department, too, had shown improvement; the sales for that period exceeded those of the whole of the preceding year. The Indian trade had been good, and was even better this year.

### British Columbia Electric Railway Co., Ltd.

The earnings for the year ended June 30th last rose from £611,483 to £642,051. (This figure includes receipts from associated concerns.) After meeting debenture interest and preference dividend, it is proposed to make a final payment of 1 per cent. on the preferred ordinary shares (making 6 per cent. for the year, less tax at 2s. 0½d. in the £, against £6 4s. per cent., free of tax, in 1926-27). The final dividend on the deferred ordinary shares is 3 per cent. (making 8 per cent., less tax, for the year, against 8 per cent., tax-free, in the preceding year). Nothing is placed to reserve (against £300 000 last year), but the balance carried forward is raised from £70,639 to £182,228.

### Barbados Electric Supply Corporation, Ltd.

The report for the year ended June 30th last refers to the consolidation of the preferred and ordinary shares into one class and to the allotment of 1,449 shares to creditors, making the total share capital as consolidated £56,621. The trading profit rose from £12,836 to £13,936, and after meeting general expenditure, debenture interest, &c., transferring £1,500 to taxation reserve, and adding £2,195 brought forward, the balance at credit of profit and loss is £12,212. From this £5,000 is reserved for depreciation and renewals, and £1,374 is put to general reserve. A dividend of 5 per cent. is recommended on the whole of the issued capital, leaving £2,007 to be carried forward. The sales of energy rose from 642,765 to 783,302 kWh, and the number of consumers from 3,541 to 3,766. Mr. A. W. Tait has resigned the chairmanship, although remaining on the board, and Col. W. F. Leese has been appointed chairman. Messrs. A. H. Wynn and A. E. Salmon have joined the board. Meeting: December 31st.

### J. Blakeborough & Sons, Ltd.

To conform with Stock Exchange requirements, this company recently published a statement relating to its business. It has an authorised capital of £275,000, of which £224,612 has been issued. The company manufactures steam, water, &c., valves, and holds the world rights, outside the United States and Canada, for the Larner-Johnson patent control valve for hydro-electric pipe lines, which is in use in many important undertakings in all parts of the world. Last year the ordinary shares received a dividend of 6 per cent., free of tax, against *nil* in the two preceding years. The company has recently issued for cash £125,000 7 per cent. 20-year cumulative notes, convertible into ordinary shares.

### Brazilian Traction, Light and Power Co.

This company has made an offer to purchase the ordinary shares, at £2 17s. 6d. per share, of the City of Santos Improvements Co., and the directors of the latter recommend its acceptance. The consummation of the purchase is dependent upon acceptance by the holders of 75 per cent. of the shares by January 15th, although the purchasers reserve the right to take the holdings of those who signify their acceptance. The conditions of the purchase include the retirement of the present directors in favour of nominees of the Brazilian Traction Co.

### Perak River Hydro-Electric Power Co., Ltd.

This company's report was reviewed in our issue of December 14th (p. 1036). The annual meeting was held last week, and in the course of his speech the chairman (Viscount Elibank) reviewed the year's activities, and said that Mr. A. H. Topham, who had had charge of the electrical construction work during the past year, had been appointed to act as general manager during the absence in England of Mr. J. Ferguson through ill-health. The motion for the adoption of the report was seconded by the vice-chairman (Sir Montague Barlow, Bt.), and carried.

### Halifax and Bermudas Cable Co., Ltd.

The net result of the working for the year ended June 30th last, after deducting income tax, was £31,244. To this is added £82,083 brought forward, making £113,327. An interim dividend of 10 per cent., free of tax, was paid in February last; the balance, £108,327, is transferred to the general reserve fund. The directors propose to pay a bonus of £12 per share from the latter fund, absorbing £120,000.

### Direct West India Cable Co., Ltd.

The profit for the year ended June 30th last, after deducting income tax, was £16,184. A balance of £12,652 brought forward is added, making £28,836. After meeting the 2½ per cent., free of tax, interim dividend, there remains a sum of £23,889, which has been transferred to the general reserve fund.

### Whitehall Electric Investments, Ltd.

Following upon the company's provisional agreement to sell its holdings in companies operating in Chile and Mexico to the Electric Bond and Share Co., of New York, it is announced that the latter concern's holding company, the American and Foreign Power Co., has arranged to sell 100,000 $6 preferred shares and £2,000,000 6 per cent. collateral notes of the South American Power Co. to Whitehall Electric Investments for the sum of £3,920,000.

### Westinghouse Brake and Saxby Signal Co., Ltd.

It is reported that the available profit for the year ended September 30th is £144,882 (against £107,118 in 1926-27). A balance of £7,582 brought forward is added, making £152,464. The reserve is to receive £27,000 (against £20,000), and the directors propose a dividend of 10 per cent. (against 8 per cent.), leaving £13,227 to be carried forward.

### Czecho-Slovakian Companies.

The Bratislava Cable Co. is increasing its capital from 37,000,000 to 72,000,000 crowns; that of the "Telegrafia" Co., Prague, is also being increased from 8,000,000 to 12,000,000 crowns.

### Clayton & Shuttleworth, Ltd.

The directors report a trading loss of £14,766 in respect of the year 1927, and a total loss of £22,184.

### Tata Power Co.

The net profit for the year ended June 30th last was Rs.4,02,647. From this Rs.3,22,500 is put to depreciation, Rs.75,068 is written off preliminary expenses, and Rs.5,078 is carried forward. The report states that the revenue was adversely affected by the failure of the Great Indian Peninsula Railway to take its estimated load, and by a mill strike. The Bombay, Baroda and Central India Railway is taking above its estimated amount of energy, and electricity in bulk is being supplied to the holders of the Bombay Suburban Electricity Licence.

### Tata Hydro-Electric Power Supply Co.

The report for the year ended June 30th last records a net profit of Rs.21,44,592, to which is added Rs.3,31,855, making Rs.24,76,447. A final dividend at the rate of 8 per cent. per annum is declared on the ordinary shares, making 7 per cent. for the year (against 8 per cent.), and Rs.5,63,224 is carried forward. Owing to industrial depression and to the fact that the Tata Power Co. took over its own load, the output fell from 131 million to 114 million kWh, and the revenue was consequently reduced.

### Edison Swan Electric Co., Ltd.

The directors announce that in future the company's year will end on December 31st instead of June 30th, as hitherto. Accordingly the current period is to be extended to December 31st and the accounts will cover eighteen months. As these accounts could not be prepared in time for the meeting to-day (Friday), that meeting will be adjourned until a later date after the transaction of other business. An ordinary dividend of 10 per cent. has been declared in respect of the twelve months ended June 30th last (as in 1926-27).

### S. Smith & Sons (Motor Accessories), Ltd.

After reviewing the past year's work at the annual meeting last week, the chairman (Mr. W. Henderson-Cleland) said that it was the intention of the company to continue to broaden its scope and to build up the reserves. It was in connection with that policy that further capital was needed, and it was proposed to create 50,000 £1 preferred ordinary shares and 280,000 1s. deferred ordinary shares. The report was adopted and the proposal to increase the capital was approved.

### Montevideo Telephone Co., Ltd.

The report for the year ended July 31st last records a net profit of £35,809, as compared with £39,489 in 1926-27, to which was added £15,217 brought forward, making £51,026. After transferring £20,000 to reserve (against £22,000), the directors propose to pay a final dividend of 5 per cent., free of tax, making 8 per cent. for the year (as in 1926-27), and to carry forward £13,655.

### Edison Bell, Ltd.

The report issued last week covered the fifteen months ended September 30th last, and showed a profit of £20,158, to which was added £9,483 brought forward and £33,139 for the sale of the company's foreign interests, making £62,780. A dividend of 12½ per cent. is paid on the ordinary shares, £3,000 is written off expenses of a preference share issue, £20,000 is placed to reserve, and £9,780 is carried forward.

### Foundation Co., Ltd.

The profit for the year ended June 30th last was £21,882 (against £21,056) and with the addition of £17,430 brought forward the available balance is £38,712. After providing £6,000 for taxation, £5,000 for housing reserve, and 8 per cent. on the 8 per cent. cumulative participating preference shares (4 per cent. already paid), £18,112 is carried forward. Meeting: To-day (Friday).

### Southern Canada Power Co.

The gross earnings of the company and its subsidiaries during the year ended September 30th last were $1,809,566, against $1,534,280 in the preceding year. The net profit rose from $627,742 to $855,073. The amount distributed in dividend on the common stock was $308,912 (against $180,000). The surplus was increased to $234,812.

### Bengal Telephone Corporation, Ltd.

The report for the year ended June 30th last shows a net profit of Rs.6,84,762 after meeting debenture interest, &c. To this is added Rs.17,420 brought forward, making Rs.7,02,182. A dividend of 7¼ per cent. is paid on the ordinary shares and Rs.32,897 is carried forward.

### Montreal Tramways Co.

The directors are issuing to present shareholders 10,000 $100 shares at the price of $150 per share, in the proportion of one new share for each six held.

### Montreal Light, Heat and Power Consolidated.

A dividend of 60 cents per common share has been declared in respect of the quarter ending December 31st.

### International Telephone and Telegraph Corporation.

The directors have declared a regular quarterly dividend of 1¼ per cent., payable January 15th, 1929.

# Stocks and Shares.

MONDAY EVENING.

THE principal aim of Stock Exchange members to-day—Christmas Eve—has been to get through their business as quickly as possible, in order to do the final shopping and arrange for the last preparations in connection with the holiday. At the same time, a good deal of business has been taking place amongst the markets, an outstanding feature being the manner in which New York has continued to buy any stocks and shares which have a transatlantic flavour. To this demand is added a widening circle of interest on the part of British investors who are taking a hand in utility and American industrial shares that promise a chance of capital appreciation in their prices.

Students of American mentality will find food for reflection in some of the financial operations that have recently taken place in New York. For example, American buying last month lifted Canadian Marconis—for no apparent reason—from 30s. to £6 within the space of a few days. Now the price is 30s. again. Ford Motor Car shares, of which 2,800,000 were offered in this country three weeks ago at £1, have been rushed up to 2½ premium by reason of American demand. In pre-war days it was always Paris that Stock Exchange men mentioned as being regardless of prices when in quest of certain shares. To-day the Americans seem to be equally indifferent to what price they pay for anything that strikes their fancy.

### "Some" Rise.

There are stocks and shares, however, which can go ahead almost meteorically without assistance from the West. British Electric Traction deferred is 20 points higher on the week at 615. This makes a rise of 100 within the course of two or three months.

### Brazilian Tractions.

Brazilian Tractions have been a lively market, rising from 70½ to 78¼ within an hour, as mentioned in our last letter. The price touched 80½ before reverting to a point below its previous quotation. The company has made an offer to purchase the ordinary shares of the City of Santos Improvements Company, Ltd., and this has added fuel to the flame of rumours which have been current for some time past in regard to the probable extension of the Brazilian Traction Company's field of operations in several directions. The preference shares rose 20 to 255 ex dividend. At the same time, liveliness developed in the shares of the British Columbia Power, the "A" rising to 60, and the "B" to 40¼ before minor reactions occurred. American and Canadian utility issues are better, though without attracting noticeable attention, and amongst Mexicans public interest is at a low ebb.

### Cable Stocks.

The second reading of the Imperial Telegraphs Bill in the House of Lords brought in buyers for the cable stocks and shares, and Easterns rose at one time from 259 to 265. This had the effect of strengthening the prices of other members of the same group, and business assumed a more active appearance than it has been doing of late. It is taken for granted that the stocks in the new company will be distributed at a comparatively early date in the New Year, and it is the expectation of what these new securities will be valued at by the market that is inducing purchases of the stocks and shares now. United River Plate Telephones have barely budged from the position that they took up when the alternative offers were announced for the taking over of the company. Venezuela Telephone are better at 27s. for ordinary and preference alike. Orientals hold their improvement, and, elsewhere, the foreign telephone division has no particular changes worthy of mention.

The spirited effort to stimulate Christmas traffic, made by the Eastern Telegraph and other cable companies, finds each year a readier response. The quantity of seasonable messages handed in over the last week-end will probably set up a new record in the volume of business handled at the temptingly low rates of cabling.

### Postal Telegraph Stock.

Postal Telegraph and Commercial Cable Company 5 per cent. debenture stock suffered a somewhat abrupt fall owing to the statement that the interest on the stock is subject to United States income tax. The company's bonds dropped from 97 to 90, and the collateral trust debenture stock, which is to all intents and purposes the same as the bonds, gave way from 95 to 88. It was suggested that the decline was overdone in view of the fact that the American income-tax cannot be more than about 7d. per cent. on the dividend warrants, and that this, although quite unexpected, hardly justifies the shrinkage such as occurred in the capital value of the stocks. The security is good, and holders need not feel alarm at the income-tax deduction. Possibly this can be recovered by stockholders who are not resident in the United States, although on this point assurance cannot be given here.

### Preference Shares Obtainable.

Of shares that are on offer in the market, and excluding most of those quoted in our regular list of prices, mention may be made of 200 Automatic Telephone 6 per cent. preference at 22s. 6d., just ex dividend and paying 5½ per cent. on the money. British Insulated 6 per cent. preference, although yielding a gilt-edged return, are extremely scarce, but a thousand Callender's **6½ per cent. preference can be bought at 24s. 9d.**, ex the December dividend, and these give £5 4s. per cent. on the money. Ericsson Telephones, 7 per cent. preference March and September dividends, yield £7 4s. per cent. at the present price of 19s. 6d. Five hundred General Electric **7½ per cent. "B" preference at 27s. offer £5 11s. per cent.**, which is not an unsatisfactory yield in view of the soundness of the security. A thousand or so of Siemens 10 per cent. preference are on offer at 33s. 6d., carrying the 1s. per share dividend due next month, and pay a shade under 6 per cent. Of United River Plate Telephone preference there are 300 obtainable at 4 11/16 ex the January dividend; these provide £5 6s. per cent. on the money.

### Particulars and Prices.

In setting-out various securities that become available from time to time in the markets, the practice here is to adopt the prices at which stocks and shares are offered. When coming actually to deal, the prospective purchaser may—and usually will—find that these prices are susceptible of improvement in the buyer's favour. We do not mean to say that where shares are offered at 25s., a bid of 23s. is likely to be of the slightest use from the serious buyer, but there is no harm in his offering 24s. 6d., 24s. 9d., or thereabouts. By process of bargaining, a lower purchase-price than that given here can often be established, though the constantly-repeated statement of the scarcity of good stock is a warning that buyers must expect to be asked what may appear to be high prices. So far as the quotations in our weekly lists are concerned, these represent the middle of the Stock Exchange official prices. And the latter are, as we have often said before, occasionally (if unintentionally) misleading.

### Electricity Supply.

County of London ordinary have recovered to 44s. upon a rise of 2s. 6d., to 66s. 3d., in Bournemouth & Poole. Recovery has also occurred in Electric Supply Corporation ordinary, to 50s. 9d. On the other hand, London Electrics eased off to 26s. Notting Hill 6 per cent. preference, quoted ex the 6s. half-yearly dividend, are left unchanged at their former, *cum* dividend, price of 10¾. Of the provincial shares, Yorkshire Electrics are a better market at 35s. and Newcastle-on-Tyne ordinary further improved to 26s. 3d. upon buying from the North, where a more cheerful sentiment is apparent in regard to the outlook for shipping, and for the coal and iron industries. Midland Counties sagged to 30s., Clyde Valleys to 38s. 6d. Egham & Staines are 36s. 6d.; North Metropolitans, to revert to London, 48s. 6d. Electrical Finance and Securities 7 per cent. preference are to be obtained at 23s. 6d., the yield at that price being £5 19s. per cent. Dividends are payable on the first of May and November.

### Railways and Tramways.

The close approach of the dividend-declaration season is directing more attention than usual to Home Railway stocks. Metropolitan consolidated at 64½ has regained its loss of last week, and Underground incomes are a point better at 126. In the tramway stocks, London United 4 per cent. debenture is quoted at 60 ex dividend: the ordinary shares are about a florin. Metropolitan Electric Tramways ordinary have not changed hands for more than a month: the last bargain in them was done at half-a-crown. Bermuda Traction 7 per cent. participating debenture is taking a long time to settle into investment hands, and it can still be bought at 6 discount below the issue price of 100. The company's shares change hands occasionally around 8s.

### Wireless.

Marconis are 1/16 better at 37s. 8d., but Marconi Marines at 3½ have shed ¼. Excitement over the shares has decreased very considerably since publication of the details providing for retention of control in British hands. Radio Corporation "A" common shares have risen 3, to 71: the "A" preferred stock remains about 11. Burndept and Everlite shares stand at the common price of 6s. Ever-Readys have been up to 28s. 6d., receding subsequently to 26s. 3d.

### The Manufacturing List.

The outstanding feature in the manufacturing group is a jump of 10s., to 5 1/16, in Enfield Cables ordinary. Explanation in the market was lacking to account for the sudden purchasing pressure applied in a market scantily supplied with shares. Telegraph Constructions went back 10s. to 24¼. The iron and steel market, as already hinted, is better on the assumption that trade is likely to improve in the near future. Vickers went up to 13s., and a number of modest advances occurred throughout the list. Rubber shares are attracting no public attention. Business in the Stock Exchange remained fairly animated up to the eve of Christmas, but members did not allow material matters to prevent entirely the exercise of more seasonable activities.

## Share List of Electrical Companies.

### Home Electricity Companies.

| | Nom. | Dividend. 1926. | Dividend. 1927. | Price Dec. 22, 1928. | Rise or fall. | Yield. p.c. |
|---|---|---|---|---|---|---|
| | £ | | | | | |
| Bournemouth and Poole ... ... | 1 | 14† | 15 | 3⅞ | +⅛ | ... ... |
| Brompton Ordinary ... ... ... | 1 | 8½ | 8½ | 27/- | — | 5 8 8 |
| Charing Cross Ordinary ... ... | 1 | 8½ | 8½ | 26/6 | — | 5 8 |
| do. do. 4½% Pref. ... | 1 | 4½ | 4½ | 17/6 | — | 5 2 10 |
| Chelsea ... ... ... ... ... | 1 | 8⅝ | 8⅝ | 27/- | — | 5 8 8 |
| City of London ... ... ... | 1 | 10 | 10 | 50/9 | — | 4 16 0 |
| do. do. 6% Pref. ... ... | 1 | 6 | 6 | 23/- | — | 5 4 4 |
| Clyde Valley ... ... ... ... | 1 | 8 | 8 | 38/6 | —1/- | 4 3 0 |
| County of London ... ... ... | 1 | 7½ | 7½ | 44/- | +1/- | 3 8 9 |
| do. do. 6% Pref. ... | 1 | 6 | 6 | 23/6 | — | 5 4 4 |
| Edmundsons' 7% Pref. ... ... | 1 | 7 | 7 | 25/6 | — | 5 9 10 |
| Elec. Supply Corporation ... ... | 1 | 11 | 11 | 50/9 | +9d. | 4 6 8 |
| Kensington Ordinary ... ... | 1 | 8 | 8 | 26/6 | — | 5 5 8 |
| Lancs. Light and Power ... ... | 1 | 7½ | 7½ | 30/- | — | 5 0 0 |
| London Electric ... ... ... | 1 | 8½ | 8½ | 26/- | —6d. | 5 7 8 |
| Metropolitan ... ... ... ... | 1 | 8 | 9 | 45/- | — | 4 0 0 |
| do 4½% Pref. ... ... | 1 | 4½ | 4½ | 17/6xd. | +4½d. | 5 2 10 |
| Midland Counties ... ... ... | 1 | 6 | 6½ | 30/- | —6d. | 4 6 8 |
| Mid. Elec. Power ... ... ... | 1 | — | 15 | 2 | — | ... ... |
| Newcastle-on-Tyne Ordinary ... | 1 | 5 | 6 | 26/3 | +6d. | 4 11 5 |
| do. 7% Pref. ... | 1 | 7 | 7 | 26/- | — | 5 7 8 |
| Notting Hill 6% Pref. ... ... | 10 | 6 | 6 | 10¾xd. | +¼ | 5 11 7 |
| North Met. Elec. 6% Pref. ... ... | 1 | 6 | 6 | 29/- | — | 5 4 4 |
| St. James' and Pall Mall ... ... | 5 | 8 | 8 | 27/6 | — | 5 1 10 |
| Scottish Power ... ... ... | 1 | 8 | 8 | 31/6 | — | 5 1 7 |
| South London ... ... ... ... | 1 | 8½ | 8½ | 27/6 | — | 5 9 8 |
| Urban Ordinary ... ... ... | 1 | 7 | 7 | 36/9 | — | ... ... |
| Westminster Ordinary ... ... | 1 | 8½ | 8½ | 27/- | — | 5 8 8 |
| Whitehall Elec. Invst. 7½% Pref. ... | 1 | 7½ | 7½ | 24/- | +6d. | 6 5 0 |
| Yorkshire Elec. ... ... ... | 1 | 8 | 8 | 35/- | +6d. | 4 11 5 |

†4% of which was tax free.

### Home Rails.

| | | | | | | |
|---|---|---|---|---|---|---|
| Central London Ord. Assented ... | Stock | 4 | 4 | 78 | — | 5 9 7 |
| Metropolitan ... ... ... ... | ,, | 8 | 8 | 64½ | +1½ | 4 13 0 |
| do. District ... ... | ,, | 3½ | 4 | 80½ | — | 4 19 5 |
| Underground Electric ... | £1 | 1½ | 5 | 26/6 | — | 3 15 7 |
| do. do. Income ... | Bonds | 6 | 6 | 126 | +1 | 4 15 8 |

### Telegraphs and Telephones.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. ... ... | Stock | 6 | 6 | 109½ | — | 5 17 1 |
| do. Def. ... ... | ,, | 1½ | 1½ | 25½ | — | 5 19 8 |
| Automatic Telephone ... ... | 1 | 10 | 10 | 2¼ | — | 4 16 10 |
| Eastern Extension ... ... ... | 10 | 10 | 10 | 26½ | — | *3 16 8 |
| Eastern Tel. Ord. ... ... ... | Stock | 10 | 10 | 262 | — | *3 16 4 |
| Globe Tel. and T. Ord. ... ... | 10 | 10 | 10 | 25½xd. | — | *3 18 2 |
| do. do. Pref. ... ... | 10 | 6 | 6 | 11xd. | — | 5 9 1 |
| Great Northern Tel. ... ... | 10 | 20 | 20 | 30 | +½ | ... ... |
| Indo-European ... ... ... | 25 | 10 | 10 | 47½ | — | *5 5 2 |
| Marconi ... ... ... ... | 10/- | 5 | *10 | 3⅞ | +1/16 | ... ... |
| Marconi-Marine ... ... ... | 1 | 6⅔ | 12½ | 9½ | —⅛ | 3 11 5 |
| Oriental Telephone Ord. ... | 1 | 12 | 12 | 8½ | — | *3 18 0 |
| United R. Plate Tel. ... ... | 5 | 8 | 8 | 11¾ | — | *3 8 1 |
| Western Telegraph ... ... ... | 10 | 10 | 10 | 26 | — | 3 17 6 |

*Interim.

### Home and Foreign Trams, &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams First Pref. ... | 5 | 5½ | 5½ | 8⅝xd. | — | 7 11 9 |
| do. do. 2nd. Pref. ... | 5 | 6 | 6 | 3/16xd. | — | 8 14 6 |
| do. do. 5% Deb. ... | Stock | 5 | 5 | 77 | — | 6 9 10 |
| British Electric Traction Def. Ord. | ,, | — | — | 615 | +20 | ... ... |
| do. do. Pref. Ord. | ,, | 8 | 8 | 124 | — | 6 9 1 |
| Brazil Traction ... ... ... | 100 | 6 | 7 | 77½ | —1 | 3 5 9 |
| Brit. Colombia Elec. Rly. Pcc. ... | Stock | 5 | 5 | 96½ | — | 5 2 7 |
| London & Sub. Trac. 5% Pref. ... | 1 | Nil | Nil | 12/- | — | ... ... |
| London United Tram Deb. ... | Stock | 4 | 4 | 60xd. | — | 6 13 4 |
| Mexico Trams, 5% Bonds ... ... | — | 5 | 5 | 79 | —1 | 6 6 7 |
| Mexican Light Common ... ... | 100 | Nil | Nil | 77½ | — | ... ... |
| do. 7% Pref. ... ... | 100 | Nil | 7 | 76½ | — | 9 3 0 |
| do. 1st Bonds ... ... | — | 5 | 5 | 77 | — | 6 10 9 |
| Yorkshire (West Riding) ... ... | 1 | Nil | Nil | 5/- | — | ... ... |

### Manufacturing Companies.

| | | | | | | |
|---|---|---|---|---|---|---|
| Babcock & Wilcox ... ... ... | 1 | 13 | 15 | 67/6 | +6d. | *4 9 0 |
| British Aluminium Ord. ... ... | 1 | 10 | 10 | 49/9 | — | *4 11 4 |
| British Elec. Transformer Pref.... | 1 | 7 | 7 | 18/- | — | 7 15 0 |
| British Insulated Ord. ... ... | 1 | 15 | 15 | 4 | — | 3 15 0 |
| Brush Ord. ... ... ... ... | 1 | 10 | 10 | 28/9 | — | 6 19 2 |
| Callenders ... ... ... ... | 1 | 15 | 15 | 4 | — | 3 15 0 |
| do 6½% Pref. ... ... | 1 | 6½ | 6½ | 1 7/16xd. | — | 5 9 5 |
| Crompton Parkinson Ord.... ... | 5/- | — | — | 20/- | — | ... ... |
| do. 8% Pref. ... ... | 1 | — | 8 | 25/- | — | 6 8 0 |
| Edison-Swan ... ... ... | 4/- | 10 | 10 | 12/6 | — | 3 4 0 |
| do. 5% Deb. ... ... | Stock | 5 | 5 | 86½xd. | —1 | 5 15 7 |
| Electric Construction ... ... | 1 | 7½ | 7½ | 26/9 | — | 5 12 1 |
| Enfield Cable Ord. ... ... | 1 | 20 | 20 | 5 1/16 | +½ | 3 19 3 |
| English Electric ... ... ... | 1 | Nil | Nil | 7/6 | — | ... ... |
| do. do. Pref ... ... | 1 | 8 | Nil | 10/- | — | ... ... |
| Gen. Elec. Pref. ... ... ... | 1 | 6½ | 6½ | 23/6xd. | — | 5 10 3 |
| do. Ord. ... ... ... | 1 | 7½ | 10 | 43/9 | — | 4 11 4 |
| Henley ... ... ... ... | 1 | 25 | 25 | 5⅝ | — | 4 9 0 |
| do. 4½% Pref. ... ... | 5 | 4½ | 4½ | 4¼ | — | 5 6 0 |
| India-Rubber ... ... ... | 1 | Nil | Nil | 11/3 | — | ... ... |
| Johnson & Phillips ... ... | 1 | 12½ | 10 | 36/3 | — | 5 10 3 |
| Met.-Vickers Ord. ... ... | 1 | 8 | 6 | 30/- | — | ... ... |
| do. Pref. ... ... | 2 | 8 | 8 | 32 | — | 5 16 5 |
| Siemens Ord. ... ... ... | 1 | 7½ | 7½ | 26/3 | — | 5 14 2 |
| Telegraph Construction ... ... | 12 | 10 | 10 | 24½ | —½ | *4 18 6 |

*Dividends paid free of Income Tax.

# Conditions and Prospects in India.

## How the New Government Purchasing Rules Affect British Manufacturers.

THE Department of Overseas Trade has issued, through the Stationery Office (3s. net), a report on the conditions and prospects of British trade in India by the Senior Trade Commissioner in India and Ceylon (Mr. T. M. Ainscough, C.B.E.). As is usual in these reports an exhaustive review of the situation is made and a great deal of light is thrown on many aspects of Indian economic affairs.

In his introduction Mr. Ainscough quotes a statement by the Finance Member of the Legislature to summarise the general position. This is to the effect that during the last two years prices in general have shown a stability unknown since the outbreak of war. Though due partly to more stable world conditions, this has been brought about principally by the standardisation of the rupee. There are clear indications that during the past year Indian commerce has made a steady advance and that the effects of the post-war trade depression are being dissipated. Mr. Ainscough shows that the financial position of the Government has continuously strengthened, which will enable the provinces to proceed with their local development schemes, and leave the Central Government free to readjust the burden of taxation and to turn its mind towards schemes for India's advancement. There have been labour troubles due mainly to the displacement of workers by improved machinery and organisation, but it is considered that conditions will improve after a period of readjustment. Racial feeling has had some effect upon the sale of British goods but, after all, price is the main consideration before which sentiment fades away. The outlook for the import trade is very promising. The iron and steel imports are likely to expand in spite of increased production in India, and the outlook for machinery and plant is good.

### Foreign Competition and Marketing Problems.

The report says that foreign competition now enters into every trade, including those which have hitherto been almost exclusively British. So far as machinery, electrical apparatus, and some other classes of goods are concerned, one of the outstanding features of the year has been intensified American competition. The American manufacturers have created a market by strenuous salesmanship and an effective use of modern advertising and distributing methods. American exporters recognise the qualifications of the British commission houses and enlist their support by giving larger commissions, attending more strictly to the needs of the country, manufacturing what is wanted, sending out mechanics and expert salesmen, and giving service after the sale is made. Behind this movement is an efficient consular and trade commissioner service. Germany is still actively competing in machinery of all kinds and is frequently able to undercut British prices to the extent of from 10 to 25 per cent. where quality is not the first consideration.

Mr. Ainscough again stresses the fact that the British manufacturer cannot afford to leave the marketing of his products entirely in the hands of others. He fails to obtain his fair share of the trade of the East because his marketing methods are not so scientific or carefully planned, having regard to the needs of each country, as his methods of production. Although a number of the larger British concerns are paying increased attention to the market, the number of efficient, modern selling organisations is extraordinarily small. Unless the manufacturer is prepared to put in a sales organisation himself, or to insist that his agents should maintain an efficient organisation, he will run the risk of losing the trade. The pace, in any market, is that set by the most efficient competitor.

### Public Service Contracts.

Mr. Ainscough devotes considerable space to the subject of the purchasing of Government stores. Some rules put forward for criticism in September last definitely provide for the preferential treatment of goods wholly or partly made in India. These rules also stipulate that important plant and machinery and iron and steel work shall only be obtained from firms approved by the Chief Controller of Stores, Indian Stores Department. With the exception of certain military supplies all articles for the public service will have to be purchased in India when the rules are put into operation, and it will be a condition that supply shall be made in India for payment in rupees in India. One of the first results of the enforcement of the new rules will be a very material increase in the purchases made in India by the Indian Stores Department and the Stores Controller of the State Railways, with a corresponding reduction in the activities of the India Store Department, London. As, however, some time must elapse before the purchasing authorities in India are able to expand their organisation to cope with all demands, it is probable that simultaneous tenders will continue to be called for in India and London for certain of the more important and highly technical items of machinery and railway plant. The stores controllers will now have a freer hand in the purchase of imported stores. They will be able to purchase from any supplier in any part of the world provided that he conforms to the regulations with regard to inspection, &c., delivers in India, and accepts payment in India in rupees.

### The Position of British Suppliers.

During the past six years, the author says, he has urged British suppliers of stores for the Indian Stores Department to so expand their Indian organisation as to be able to meet the Government's requirements as completely and efficiently as they have hitherto met them in London. Most British manufacturers of machinery and engineering stores have already taken action on these lines. The following advice regarding the type of organisation required is given: There are advantages (from the point of view of Indian preference) in the registration of an Indian limited liability company with rupee capital and a proportion of Indian directors. Besides maintaining adequate stocks in India manufacturers should acquaint the stores controllers of the nature and extent of these and ask to be included in the lists of approved contractors. Generous terms should be given to agents in view of the liberality of some foreign rivals. As under the rupee tender system payment will actually be made in India extreme care should be exercised in the choice of agents. Manufacturers are reminded that the new rules do not provide for the exercise of any preference for British goods; the latter will have to be sold purely on their merits and the suitability of the Indian organisation set up.

The extent of Government purchases may be gauged from the following figures which relate to the year 1927-28: The Indian Stores Department purchased engineering and allied goods to the value of Rs. 2,54,21,933 (against Rs. 2,35,95,952 in 1926-27). Included in this were electrical power plant (Rs. 8,27,000), electric fans, lamps and fittings (Rs. 8,87,000), electrically-driven haulage gear (Rs. 2,72,000), electrical distribution material (Rs. 1,84,000), and Maconite cables and fittings (Rs. 1,08,000).

During 1926-27 the Department of Posts and Telegraphs purchased goods to the value of Rs. 66,94,399. The value of stores purchased in India showed little change, but the amount purchased in England fell from Rs. 13,69,000 to Rs. 8,36,500.

### Public Works.

These form the subject of several pages of the report. From the electrical point of view the Punjab water power scheme (Uhl River project) is of the greatest interest. Lt.-Col. B. C. Battye, R.E., reports that progress during the past year has consisted mainly in the completion of the construction equipment. This has included the temporary power plant at Dhelu, the completion of the haulage-ways, and the installation of tunnel construction plant, compressor stations, blowers and excavating machinery. The construction of the second subsidiary power project in the Uhl Valley was expected to be completed in July. Contracts and orders for construction plant have, therefore, now been practically completed; the bulk of the work remaining is connected with the specifying and calling for tenders for the pipeline, generating plant, switchgear, transformers, transmission line towers, and sub-stations. The specifications for these were well in hand, and it was anticipated that tenders would be called for the bulk of this plant and machinery during last autumn. Tenders for the sub-stations and power house switchgear will probably follow a few months later.

Major H. G. Howard, Chief Engineer for Hydro-Electric Development to the Madras Government, states that the Government considers that the preliminary surveys of the Pykara, Pinjikave and Papanasam projects, warrant a more complete investigation. A Department of Hydro-Electric Development was formed and in November last year it issued an introductory report upon the Pykara project. The development of electric power in Southern India on a reasonably large scale depends upon the electrification programme of the South Indian Railway. Two schemes have been proposed. One includes the electrification of three sections of the Railway and the transmission and distribution of power to the Nilgiris, Coimbatore, Tirupper, Erode, Pollachi, Anamalais, Trichinopoly, Dindigul, Madura and Virudhunagar. The smaller scheme, which assumes that the Railway will decide not to electrify, only includes a supply to the Nilgiris and Coimbatore district. The Railway Board has sanctioned the electrification of a section of the Madras suburban lines of the South Indian Railway and preparations for commencement are being made. If the construction of the Pykara project is sanctioned it is not expected to attempt to transmit power to Madras at the outset but to wait until the demand increases. The Pykara undertaking calls for the construction of a power station with three 7,500-kW generating sets working under a static head of 3,090 ft. There will be about 190 miles of 110-kV transmission lines and 180 miles at 66 kV.

On January 1st, 1928, the Government of Ceylon took over the electricity supply system of the Colombo Electric Tramways and Lighting Co., Ltd. The 2,700-kW station is now fully loaded and a new station at Kolonnawa, containing two 3,000-kW sets, is under construction. All new consumers will be supplied with a.c. and the supply to existing consumers will be gradually changed over.

The electricity supply of Colombo is now entirely under control of the Ceylon Government, but it is not intended that

the Government should carry out any extensive wiring schemes for consumers' premises, all such work being done by local contractors. The Government will, however, encourage the demand for electricity in every possible way, and will offer easy terms where necessary for the hire-purchase of motors and other current-consuming appliances if contractors are not able to meet consumers' requirements. Work on the hydro-electric scheme has been stopped pending further investigations.

Mr. J. S. Pitkeathly, C.I.E., Chief Controller of Stores with the Government of India, has been "loaned" to the Government of Ceylon. He will thoroughly investigate the practicability of the hydro-electric scheme and will report on the measures which should be taken to deal with the present unsatisfactory position.

Work in connection with electric lighting installations in small towns throughout the Island continued during the year. The standard form of installation adopted for small towns is 400-230 V, 3-phase, 50-cycle oil engine sets. The installations are usually carried out by private firms under the supervision of the Government Electrical Department on specifications prepared by the Department.

### Electrical and Allied Imports.

During 1927-28 electrical machinery to the value of Rs. 2,00 lakhs (against Rs. 2,29 lakhs in 1926-27) was imported. In spite of this reduction it is stated that the demand is expected to expand during the next few years owing to the number of power schemes which are under construction. The important schemes for railway electrification in Bombay, Bengal and Madras are likely to provide an outlet for large quantities of plant. The bulk of the machinery was supplied by Great Britain, although its share fell from Rs. 1,86 lakhs to Rs. 1,66 lakhs. The shares of the other principal suppliers, the United States and Germany, also decreased however. Prices were closely cut and most of the orders for large power plant were taken at prices which showed little, if any, profit. The imports of boilers increased considerably (from Rs. 62 lakhs to Rs. 1,09 lakhs) and the United Kingdom maintained its ascendancy.

Imports of electrical apparatus rose from Rs. 2,52 lakhs in 1926-27 to Rs. 2,83 lakhs in 1927-28. The principal item—wires and cables—rose in value from Rs. 81 to Rs. 90 lakhs, and all other classes recorded rises. In the same way each supplying country increased its share, the United Kingdom from Rs. 1,70 to Rs. 1,85 lakhs, the United States from Rs. 33 to Rs. 35 lakhs, and Germany from Rs. 22 to Rs. 28 lakhs. There was a notable advance in imports of radio apparatus, a separate item, *i.e.*, from Rs. 4.9 to Rs. 15.7 lakhs; this was due to the commencement of broadcasting from the Bombay station, and the figure included a considerable amount of station apparatus. The proportion provided by the United Kingdom rose from Rs. 4.3 to Rs. 10.6 lakhs.

# Electrical Trade in the Irish Free State.

## Canadian and American Views.

AN investigation of the market in the Irish Free State for electrical appliances has recently been made by the Canadian Trade Commissioner in Dublin (Mr. F. W. Fraser). Much of what he says is of value to British exporters of these goods. While pointing out that this market has been dominated in the past by the manufacturers of Great Britain, he states that in recent years foreign competition has become more evident, particularly in household appliances. Presumably as the result of this investigation on Canada's behalf, competition from the Dominion may be a factor of growing strength. The main reason for the increased attention given to the Irish market is, of course, the approaching completion of the Shannon power scheme and its transference to the Electricity Supply Board, which intends to sell electrical appliances to its customers in direct competition with existing dealers. For this purpose it is proposed to open a chain of showrooms throughout the Free State, where demonstrations will be given and appliances will be displayed and sold.

### How to Cultivate the Market.

Mr. Fraser considers the field capable of considerable development, and sets out three principal alternative methods of attacking the Irish market, *viz.*: (1) By tendering for the requirements of the Electricity Supply Board; (2) by arrangement with existing factors in London; (3) by establishing a selling organisation in Dublin. It appears doubtful to Mr. Fraser whether Canadian firms, without able representation in Dublin, could deal effectively with this business by the first method. The second method, he says, is that adopted by a number of American and German manufacturers with some success where the London factor has a sub-agent in Dublin. In mentioning that the leading British manufacturers maintain depôts in Dublin, supplying the contractor and retailer, Mr. Fraser adds that two American firms have arranged to enter the Free State market directly rather than, as previously, through London. The method recommended to Canadian manufacturers who may contemplate entering this market is to go direct to London and either establish their own office there, or appoint a selling agent, who will carry stocks, and work the Irish market through a sub-agent in Dublin. Stocks must be immediately available, and advertising and energetic canvassing are essential. In the Trade Commissioner's opinion large sales await the manufacturers who adopt these methods.

### The Existing Position of Appliances.

With a number of appliances he deals in detail, as follows:—Greater progress has been made in the sale of suction sweepers in the Free State than in any other appliance, and this is apparently due to the systematic working of the market. Several well-known makes are on sale, but those enjoying the greatest popularity are the ones for which a selling organisation has been set up in Dublin, and which are sold by house-to-house canvass, and on a time-payment basis.

The sale of electric irons has increased very rapidly during the past few years in the Dublin area, and it is thought that with the educational propaganda of the Electricity Supply Board, supplemented by advertising, and the provision of electricity to a number of centres not hitherto supplied, the sale of these should be further increased. German irons appear to have the greatest popularity, and a number of English makes are on the market. American irons appear to be less well known. The market for washing and ironing machines has not yet been worked to any great extent. With the advent of cheaper power from the Shannon, however, it is almost certain that more attention will be given to these lines in the future. Quite recently a demonstration was given in Dublin by an American manufacturer which attracted considerable attention.

The use of table cooking appliances has not achieved any great degree of popularity as yet in the Irish home, but this is probably due to the lack of any properly organised sales effort for these lines on the part of the dealers.

While the demand for refrigerators has been negligible in the past, it is expected that the enforcement of the "Preservatives in Food Regulations," which became operative on October 1st, 1928, and closely follow the existing British regulations, will lead to a large demand for refrigerators. Already two leading American manufacturers have established branches in Dublin, and it is reported that one of them has secured a contract for supplying a number of co-operative creameries with electric refrigerators.

### Customs Duties.

It should be added that while electrical apparatus as such is not subject to Customs duty on entering the Free State, an import tariff of 33⅓ per cent. *ad valorem* was imposed some time ago on articles of furniture completely or partially manufactured, made wholly or partly of wood. This has been interpreted by the Revenue Commissioners to include many articles of household use not ordinarily classed as furniture, but having handles or other parts made of wood, such as electric irons, percolators, &c. Suction sweepers have been excepted from this classification and are admitted free. It is the practice of some importers to have the wooden parts shipped separately, thus limiting the duty payable to such parts only. This is not always practicable, however, and in that case duty is exacted on the complete article.

### An American Opinion.

In a recent article on the Shannon Scheme by the American Vice-Consul in Dublin the view was expressed that, while Great Britain holds a dominant position in the Irish electrical trade as a whole, foreign competition is becoming considerably more noticeable in the sphere of household appliances and medical and dental equipment, where American, German and Swedish manufacturers figure prominently. The position of German electrical equipment on the Irish market has been improved considerably by the fact that the German concern, Siemens-Schuckertwerke, is engaged in the construction of the Shannon project, and the German industry has made progress in the sale of appliances since work was commenced on this undertaking. Swedish competition is not yet general in the electrical trade, but is confined to certain lines, mainly household appliances.

As a general rule, states the writer, American prices are higher than those of competing lines, but the superior quality and advanced construction of most appliances have gained a prestige among the more well-to-do consumers which competitors have found difficult to counteract even through the quotation of more attractive prices.

# An Electric Winding Installation.

**Two electric winding equipments, of 2,450 and 1,400 h.p., respectively, have recently been installed at the McIntyre Porcupine Mines, Canada.**

AN important contract for electric winding plant has recently been completed by the General Electric Co., Ltd., for the McIntyre Porcupine Mines, Ltd., at Schumachr, Ontario, Canada, where a new shaft has been sunk to a depth of 4,100 feet, excluding the sump. The new shaft has five compartments, containing two rock skips, one cage (man hoist), and ore and waste bins. The ore is mined at different points and is dumped at the loading pocket at the 4,100-ft. level, whence it is hoisted to the surface by the rock hoist in skips, each holding 12,000 lb. when fully loaded. Twenty-three stations can be served by the cage with men, tools, timber, powder and material.

Two complete winding equipments are installed, one for operating the rock hoist, and the other for the cage hoist. In each case double-drum electric winders are installed, the motors being controlled on the Ward-Leonard system. Both hoists are installed on the surface and will normally work under balanced conditions. They are capable of 24 hours' continuous duty.

The maximum winding speed of the rock hoist is 3,000 ft. per min., and of the cage hoist 2,000 ft. per min. The cage hoist operates the cage from one drum and an 18,500-lb. balance weight from the other. The rock hoist has to serve loading boxes at various levels, but later the whole will be hoisted from the 4,100-ft. level. The drum shaft of each hoist is directly coupled to the driving motor. The rock hoist is driven by a 2,450-h.p. motor, and the cage hoist by a 1,400-h.p. motor of the same type. Power for the Ward-Leonard motor-generator sets is taken from a local electricity supply at 2,200 V, 25 cycles. The motor of each Ward-Leonard generator set is a 1,700-h.p. machine running at 500/425 r.p.m. The machines are made in duplicate in order to minimise the number of spare parts. The generator for the rock hoist has an output of 2,000 kW, the set being provided with a flywheel, while the normal output of the generator for the cage hoist is 1,200 kW. The winder motors and motor-generator sets are amply proportioned to deal with the very heavy starting loads encountered at the beginning of each wind, and other severe duties required of winding plant.

**Fig. 1.—Slip Regulator for 2,450-h.p. Motor.**

The speed regulating gears for the two hoists are identical, and each consists of a faceplate controller with contacts mounted in a large circle on a slate panel. The moving arm is carried on a shaft passing through the centre of the contact circle, and interlocking contacts are mounted on this shaft at the rear of the slate panel. The whole gear is itself fixed in a substantial metal housing, and is equipped with a quadrant and pinion for coupling to the control lever. The controller is connected in the field circuit of the generator, so that as its field is varied from a positive maximum to a negative maximum the speed of the winder motor varies in a corresponding manner and is only slightly affected by varying loads. Fig. 1 shows the slip regulator for the 2,450-h.p. winder, and fig. 2 gives a view of the cage winding equipment.

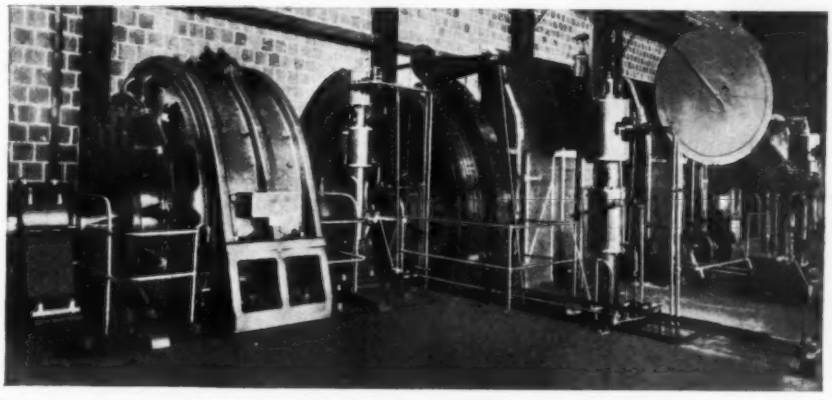


**Fig. 2.—1,400-h.p. Electric Winder and Cage Hoist.**

In each case the winder motor and generator are connected together in a continuous electrical circuit without any switches or interrupter gear. The d.c. side is protected against dangerous overloads by suitable relays which cut off all excitation in the event of the current exceeding a definite maximum. As the d.c. circuit is always closed "suicide contactors" are provided to prevent the remanent magnetism in the generator field system from building up sufficient voltage to cause heavy circulating currents in the stationary motor armature. These contactors are always in the "suicide" position when the control lever is in the "off" position, and only move to the running position when the preceding operations have taken place in correct sequence.

The exciter for the winder motor and generator is shunt wound, and has a contactor inserted in its field circuit, which is so interlocked with the equipment as to prevent the exciter from generating any voltage unless the plant is electrically in order. The brake magnet is connected directly across the exciter through a brake contactor, so that in the event of voltage failure the brake is immediately applied.

In the case of the rock hoist, which is provided with a flywheel, an automatic voltage regulator is necessary to maintain a reasonably constant exciter voltage, irrespective of speed changes on the motor-generator set. The flywheel set is provided with an automatic slip regulator connected in the rotor circuit of the induction motor. This regulator is designed on conventional lines, except that the torque motor is placed at the foot of the tank and geared to the dipper rod. This arrangement is preferable to mounting on the top of the tank, as the motor is free from all water vapour and the sensitiveness is increased. A current relay in the line interlocked with the generator prevents the winder from being started up until the load on the mains has decreased to the light load of the motor-generator set.

Thanks are due to the McIntyre Porcupine Mines, Ltd., for permission to publish this article.

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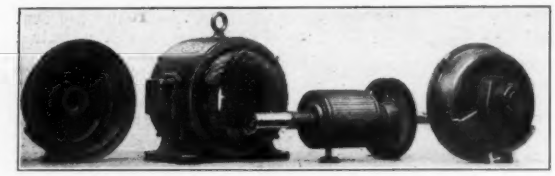
### A Voltage Drop Calculator.

We have received from the BRITISH INSULATED CABLES, LTD., a useful little pocket device for calculating the voltage drop in two-wire and three-phase circuits, given the length of line and conductor size. It can also be employed for calculating the size of cable required to supply a given load.

# A High-Torque Motor.

**The "Verity-Heemaf" double-squirrel-cage motor has a large starting torque and small starting current.**

ALTHOUGH the ordinary squirrel-cage motor has advantages over the slip-ring machine, owing to its simplicity and greater factor of safety, its inherent weakness lies in the fact that it has a poor starting torque and needs abnormally large starting current. Once brought up to speed, however, it has a high efficiency and power factor, and runs at practically constant speed between no-load and



**"Verity-Heemaf" Motor, Dis-assembled.**

full-load. The "Verity-Heemaf" s.c. motor which has recently been introduced by Messrs. Veritys, Ltd., is so designed, it is claimed, as to eliminate the weaknesses referred to. It has two squirrel-cage windings, similar to the Boucherot motor, but, owing to important patented modifications, the results are obtained without sacrificing either efficiency, slip or power factor. The following table contains data determined by actual tests of "Verity-Heemaf" motors:—

| B.H.P. | R.P.M. Full Load | Efficiency % | P.F. | Starting Current in % of F.L. Current (Star position) | Starting Torque in % of F.L. Torque (Star position) |
|---|---|---|---|---|---|
| 5 | 1,450 | 86 | .84 | 150 | 100 |
| 15 | 960 | 87 | .84 | 150 | 80 |
| 20 | 960 | 88 | .85 | 150 | 80 |

The "V-H" three-phase motors may be started by direct switching, star-delta starter or auto-transformer starter.

The accompanying illustration (above) shows one of the double-squirrel-cage motors dis-assembled. The following notes from the makers' specification may be of interest:—

The cast-iron stator frame is of rigid construction, and is provided with ample space for ventilation and accurately machined to receive core stampings. These, as also are the rotor stampings, are of best quality iron, suitably insulated, and of such thickness as to minimise hysteresis losses. The coils are held firmly in position, and the finished stator is thoroughly stove dried and impregnated in vacuum, rendering it practically damp-proof. The rotor contains two independent squirrel-cage windings, each consisting of a number of copper bars embedded directly in the rotor iron and brazed to copper end rings. The outer winding has a high resistance and low inductance, and the inner winding has a low resistance and a high inductance. The co-operation of the two windings results in a high starting torque and low starting current. The bearings are of the oil-ring type, or, alternatively, ball or ball and roller type. The terminal box is mounted on the left-hand side of the stator frame, looking from the driving end. The motors, with one exception, are of the protected type and drip-proof. Overloads and temperature rises are in accordance with B.S.S. 168-1926.

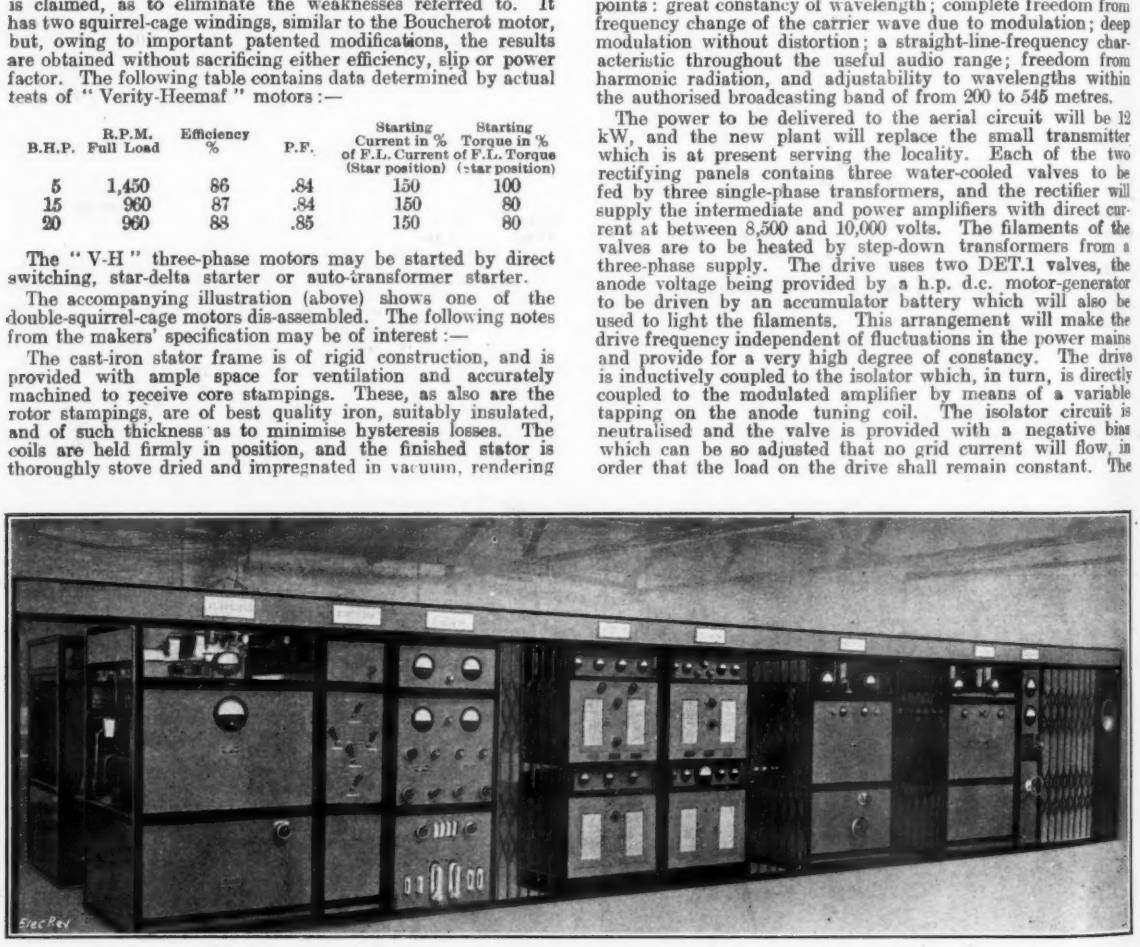
# Bratislava Broadcasting Station.

**Some Details of Marconi Type PA.5 Radio-Telephone Broadcasting Plant to be Installed in Czecho-Slovakia.**

THE Czecho-Slovakian broadcast radio-telephone organisation is building a chain of five transmitting stations to complete the very efficient service in that country. The new high-power station shortly to be erected by Marconi's Wireless Telegraph Co., Ltd., at Bratislava will be one of the largest of them, and it will serve that country in the equivalent manner to the British Broadcasting Corporation's regional stations in the British Isles.

It will be appreciated from the accompanying illustration that the transmitter has been constructed on the "unit" system, each circuit being carefully screened from its neighbours to prevent the introduction of spurious signals which would distort the quality of transmission. The panels shown in the illustration (below) are, from left to right, rectifiers with the control switchboard; two totally-enclosed panels containing the drive, isolator, and the modulated amplifier with the modulator; the intermediate amplifier and the power amplifier. Access to the transmitter can be obtained readily by means of the safety gates between the panels, power being cut off when the gates are opened. When designing the type PA.5 transmitter particular attention was given to the following points: great constancy of wavelength; complete freedom from frequency change of the carrier wave due to modulation; deep modulation without distortion; a straight-line-frequency characteristic throughout the useful audio range; freedom from harmonic radiation, and adjustability to wavelengths within the authorised broadcasting band of from 200 to 545 metres.

The power to be delivered to the aerial circuit will be 12 kW, and the new plant will replace the small transmitter which is at present serving the locality. Each of the two rectifying panels contains three water-cooled valves to be fed by three single-phase transformers, and the rectifier will supply the intermediate and power amplifiers with direct current at between 8,500 and 10,000 volts. The filaments of the valves are to be heated by step-down transformers from a three-phase supply. The drive uses two DET.1 valves, the anode voltage being provided by a h.p. d.c. motor-generator to be driven by an accumulator battery which will also be used to light the filaments. This arrangement will make the drive frequency independent of fluctuations in the power mains and provide for a very high degree of constancy. The drive is inductively coupled to the isolator which, in turn, is directly coupled to the modulated amplifier by means of a variable tapping on the anode tuning coil. The isolator circuit is neutralised and the valve is provided with a negative bias which can be so adjusted that no grid current will flow, in order that the load on the drive shall remain constant. The modulated amplifier consists of two shielded stages mounted in one framework and placed beside the drive circuit: one stage mounts the modulated amplifier with its high-frequency circuit and the other the modulator and sub-modulator, together with the speech choke, &c. The high-voltage supply for the isolator and the modulated amplifier will be provided by another h.p. d.c. motor-generator, the voltage being reduced by resistances where necessary. The modulator is resistance-capacity coupled to the sub-modulator, and the latter is arranged for resistance-capacity coupling to the output line amplifier. The design of this stage is such that full modulation of the modulated amplifier will be obtainable before grid current flows in the modulator valve. The intermediate



**Type PA.5 Marconi Broadcast Radio-Telephone Transmitter.**

amplifier consists of one water-cooled valve with its oscillatory circuits. The grid circuit is tuned and strongly damped to prevent side band cut-off and also make the valve stable without neutralising the valve capacity. The intermediate amplifier is inductively coupled to the power amplifier by means of a tuned circuit. Three water-cooled valves connected in parallel form the power amplifier, and the high-frequency circuits are completely shielded in a metal cabinet. Inductively-coupled to the tuning coil of this circuit is a filter which will cut off all harmonic frequencies of the fundamental wave-length. To prevent any direct action on the aerial by stray fields produced by the oscillating valves which might nullify the effect of the filter in cutting out harmonics, a feeder some 100 metres in length is to be inserted between the filter and the aerial circuit.

The aerial will be supported by two towers 300 ft. high and about 600 ft. apart, and a buried earth system will be employed.

# The Attenuation of Wireless Waves.

## Some results of an experimental and theoretical investigation of the absorption of radio waves produced by their passage over a town; the attenuation increases extremely rapidly with the frequency of the waves.

By R. H. BARFIELD, M.Sc. (Eng.), A.M.I.E.E., and G. H. MUNRO, M.Sc., Graduate I.E.E.

(*Extracts from Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THIS investigation, which was carried out as part of the programme of the Radio Research Board (Department of Scientific and Industrial Research), has disclosed important differences between town and country attenuation. The first part of the work is supplementary to an earlier paper*. A polar curve of the signal strength of the British Broadcasting Corporation's London station (2LO, 361.4 m., 830 kc.) has been used to revise the original signal-strength contour map. The conclusions arrived at in the previous paper are in no way modified by the new work, as the check measurements all confirmed the earlier results. The divergence of the revised contour map from the original is due partly to the fact that some of the interpolations in the old map have been replaced by actual measurements, and partly because 2LO meanwhile changed its aerial system; in particular, the presence of mast shadow is now apparent.

In order to obtain a polar curve of radiation for the 2LO aerial, observations were taken on suitable sites approximately on a radius of 10 km. from the transmitter at intervals not greater than 10 degrees. Local variations were large, amounting to as much as 40 per cent. in two miles on an arc in one case at North Bromley. Usually there was no indication of the cause of these variations, as telegraph wires, trees, &c., were avoided in choosing a site. In most cases their proximity resulted in a reduction in the signal strength and also a flattening of the minimum, which detracted from the accuracy. In one case, beneath a set of telephone wires, the minimum was more than 50 per cent. of the strength of the maximum.

The theoretical value of the intensity of 2LO at 10 km. from the transmitter, neglecting the effect of surface attenuation, can be calculated (the effective height of the transmitting aerial being approximately 30 m., the aerial current being 9 amperes, and the wave-length 360 m.) as =28 mV per metre. The average value obtained from the polar curve is about 30 mV/metre; there thus appears to be no attenuation due to the surface, which is unexpected, since the district transmitted over is dense town area. This may be further evidence of the "negative" surface attenuation effect in the neighbourhood of the long-wave Daventry station, or it may be that the effective height of the transmitter is greater than that assumed, owing to the fact that the aerial is on a high building.

Two distinct minima on the polar curve are due to the directional characteristics of the aerial, owing to the current induced in the two masts. The axis of the minima (W.S.W. and E.N.E.) coincides closely with the direction of the line joining the two masts. To produce the decided shadow effect shown on the polar curve, the current induced in the masts must be of the same order as that in the aerial. This is rather surprising, considering that the height of the masts (40 m.) is well under ¼ wave-length and therefore well out of resonance with the waves.

The most striking characteristic of the second part of the investigation is the extremely rapid falling-off of intensity with decrease in wave-length of the order of 4 : 1 for a wave-length change of 20 per cent. The results indicate two distinct effects: first, that when the transmission is wholly over a dense town area there is a very marked increase of attenuation with frequency. Thus over a range of wave-lengths (260 to 440 m.) the change in intensity over 10 miles, of which only four are in town area, is approximately 9 : 1, which corresponds to a variation proportional to the fourth or fifth power of the wave-length, whereas Sommerfeld's theory does not allow for any change exceeding a square law. Secondly, a turning-up of the curve on the lower wave-lengths cannot be neglected: when the transmission is over well-populated suburban areas there is selective absorption of energy on a wave-length of between 320 m. and 350 m.; it seems that this can only be caused by the numbers of receiving aerials all tuned to 360 m., the wave-length of 2LO, which conclusion is supported by the fact that the dip in the curve which indicates that selective absorption is a maximum when the area traversed contains the maximum number of houses and decreases as the number of houses decreases.

Thus we may sum up the conclusions as follows: for transmissions confined to "town" areas only, consisting of offices, large buildings and residential districts without gardens, there is a very important increase of attenuation with frequency obeying approximately a fifth-power wave-length law, but there is no sign of any selective absorption due to receiving aerials. Over suburban areas only there is marked selective absorption, this effect being a maximum on a wave-length *just below* the wave to which the aerials are tuned. When the area traversed combines the two cases there are some indications that the steep attenuation/wave-length curve is combined with the selective absorption curve.

The experimental results have shown clearly that the attenuation of waves over a large town is different from the attenuation of waves over the country. There appear to be two distinct effects, according to the nature of the surface which the waves traverse: over a town itself the attenuation is determined by the absorption of energy in vertical metal conductors, such as pipes of all kinds, electric wiring, steel frames, &c., and possibly by the dielectric losses in bricks, cement, stone, and woodwork. The particular feature of the attenuation is that it increases very rapidly with the frequency of the waves: thus, when the amount of town traversed is of the order of 3 miles, or more, the signal strength decreases as the fifth power of the wave-length over the range dealt with in the experiments (roughly the broadcast range). From a theoretical investigation based on an extension of Sommerfeld's theory this rapid change appears to be consistent with the assumption that the losses occur in vertical conductors.

It appears that tuned aerials in the dense part of a town do not affect the attenuation, the energy they absorb being negligible compared with that absorbed by the masses of other conductors, due to the fact that such aerials are usually very inefficient and heavily screened. Over the suburbs, however, the extra rapid rate of change of attenuation with wave-length disappears, but if there are aerials tuned to the same wave-length they play an important part.

The experiments show that a comparatively small area of about 5 km² may produce a selective decrease of signal strength to half its normal value, and that the wave-length for lowest signal strength is slightly below the wave-length to which the aerials are tuned. The actual position of the minimum appears to vary with the number of aerials traversed. An explanation of this effect is obtained by considering the shadow effect produced by the aerials as well as the energy they absorb, and a calculation based on rough estimates of the density of distribution and constants of typical aerials confirms that they should produce an appreciable effect.

The results can be used to a certain extent to discuss the effect of towns in connection with proposed schemes of broadcasting. Suppose a transmitter T is situated just outside a large town and works on two wave-lengths, 440 m. and 260 m. respectively: consider two receivers A and B, say 30 km. distant from the transmitter, A placed so that the waves have to travel right across the town, B so that the waves travel free of the town. Assume that at B the intensity on 440 m. is 6 mV/metre, then at the same point, and with the same power radiated, it will be about 2 mV/metre on 260 m. At A the experiments show that on the longer wave the strength will be about the same as at B, whereas on 260 m. it will drop to about 0.4 m/V-metre. In other words, it seems that, at the upper limit of the broadcasting range, towns have little effect, whereas on the lower range they cast a very decided shadow: again, assuming now that the two wave-lengths were only about 20 m. apart, the field strength on the shorter one might be appreciably affected by the aerials tuned to the longer wave-length, but that of the shorter one would probably not be influenced to any great extent by any of the tuned aerials.

Confirmatory experiments with short waves (shorter than 1/10 of those previously employed) are described in an appendix; they also emphasise the difficulty of calculating the resultant field strength in a region influenced by receiving aerials.

* "The Attenuation of Wireless Waves over Land." See ELEC. REV., December 16th, 1927, p. 1056.

# Electrical Circuit-Breaking.

## An introduction to the British Electrical and Allied Industries Research Association's investigations (Report G/T34) of arc rupture, which have been in progress since 1922.

By E. B. WEDMORE, M.I.E.E., W. B. WHITNEY, Ph.D.(Eng.), and C. E. R. BRUCE, M.A., B.Sc.

(*Extracts from Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE electrical circuit-breaking problem can only be solved by separate study of the numerous variables involved. The apparatus used at the Carville electricity generating station of the Newcastle Electric Supply Co., Ltd., include a 5,750-volt, 5,000-kW, 40-cycle, 3-phase turbo-alternator, together with instrument and testing gear designed and installed by the E.R.A. As an indication of the amount of work carried out to date it may be mentioned that nearly 3,000 tests have been made, each of which involved recording from 50 to 100 items of information on the test day itself, and altogether requiring about five miles of oscillograph records.

It has been the custom to speak of quenching the arc in oil: the tendency was towards higher speeds of break, the use of magnetic blow-outs, and other violent methods of interfering with the arc as essentially and necessarily good. It is true that a small amount of drawing out and struggle is necessary in preparation for the vulnerable period of zero current, but the whole of the authors' work shows that the attack on the arc has, in the past, been in the wrong direction and has in effect been directed on the arc when it was most capable of resisting, rather than at the zero pause.

The investigators aimed at means for preventing the arc from re-striking, rather than attacking the arc when heavy current is flowing, which may cause heavy energy release. An oil switch arc is often broken while the contacts are still within the gas bubble, so that arc extinction is not due to the quenching effect of the oil. Experiments have proceeded along two lines: study of the (1) gas formed and of its arc-rupturing properties, as compared with other gases, with a view to its utilisation to full advantage in arc rupture; and (2) best methods of utilising the good features of oil for like purpose, the general aim being the utilisation of each method separately, or in combination, in improved, or new, designs.

Tests, under controlled conditions impossible to obtain in commercial service, on a number of different types of commercial circuit breakers, in order to verify their rupturing capacity and performance characteristics, both under single-phase and 3-phase conditions of operation on short-circuit, proved fully justified and, since 1923, British manufacturers have had the benefit of the numerous observations on design made at that time, leading to various improvements giving increased reliability. The experiments have since shown that alteration of any one of the many variables may result in marked change in behaviour of the circuit-breaking device. That a given oil circuit-breaker will show a marked variation of performance on repeat tests under the same external circuit conditions has been universally attributed to varying degrees of asymmetry of the short-circuit current and to the contacts having separated at varying points in the current wave, but these explanations have been found to be quite inadequate. It is believed that the main sources of such variations have now been traced, supported by the fact that, on certain models, uniformity of operation can now be obtained; this will form the subject of a later paper.

In addition to the oscillograph apparatus, the authors obtained numerous records of pressure phenomena: a number of different methods of recording have been developed and the authors have been able for some time past to obtain continuous records of variations in oil pressure in such a way that they can be correlated with arcing and other phenomena in the same experiment. Pressure is not dealt with in the present paper, but a pressure as high as 1,000 lb. per sq. in. on the walls of a closed experimental model has been recorded when tests were being made with initial pressures in an air cushion. A higher pressure would have been reached had not the arcing cylinder exploded.

A novel camera capable of working at upwards of 1,000 pictures per second was designed and by means of it the authors obtained information of great value on the phenomena of the development of the arc globule. It was arranged to correlate in time the high-speed camera records with the oscillograph records so that the electrical phenomena at any instant could be studied in conjunction with what was going on in the oil. The development of this camera presented some difficulty because oil normally cuts off most of the actinic rays which are so necessary to obtain good records at high speeds, and it was impossible to employ artificial illumination for studying the arc itself.

Novel methods of gas sampling during arcing in oil were employed; analysis of the samples gave the following average composition by volume:—

| | |
|---|---|
| Acetylene ... ... ... ... ... | 23 per cent. |
| Ethylene ... ... ... ... ... | 3 " " |
| Hydrogen ... ... ... ... ... | 69 " " |
| Methane ... ... ... ... ... | 5 " " |

The acetylene content observed is much greater than has been generally noted by other investigators, which may be due to the fact that acetylene is soluble in water and oil and that previous investigators may not have made correction for the amount absorbed in the process of collection and analysis; the highest so far recorded is 31 per cent. and there is some evidence of a gradual increase as current increases. Pure acetylene is capable of being detonated at a compression of a few atmospheres, in the absence of oxygen, and to give rise to very high pressures, but the authors have so far no definite evidence that such detonation takes place in arcs in oil. The effect of the chemical nature of the oil on the chemical composition of the gases evolved therefrom appears to be small. When correction is made for the proportion of energy absorbed by the contacts(1), the volume of gas produced averages about 70 cm³(2) per kW-second of arc energy. This is rather higher than figures obtained by other investigators with smaller amounts of power, in which cases, however, no allowance was made for energy dissipated at the contacts(3). There is reasonable correspondence between the lengths of arcs in hydrogen alone and in oil circuit-breakers after allowing for superimposed phenomena which occur in the latter, thus showing incidentally that the presence of the oil is not essential for arc extinction. It was not possible to rupture arcs in air, nitrogen, and argon, under similar conditions without very much longer breaks than were required in hydrogen. This characteristic of hydrogen has certain advantages, which are thus present in the commercial oil circuit-breaker. The study of arcs of different types has been extensive and is still in progress.

The phenomena of the a.c. arc may be divided into (i) the period of current flow, and (ii) the period when no current flows and the gap between the contacts is filled with hot gas. For given gaseous conditions at current pause, the adequacy of the gap depends on the instantaneous value of the voltage gradient appearing across it at current zero, and for arcs in hydrogen the length of critical gap is approximately proportional to the sine of the angular displacement between current and "virtual" voltage zeros; this differs radically from Bauer's conclusions. In arcs in oil there are superimposed phenomena, but in general the same law applies. With asymmetrical currents in gas and oil there is a phase-displacement effect which affects the available voltage in addition to the phase angle due to circuit conditions.

Arc-voltage characteristics indicate that Norberg's application of Steinmetz's formula, if used over the range considered in the present paper, would lead to large errors in the results obtained for arc energy, whereas his experimental results, though few in number, are consistent with the results here described.

The authors' researches have provided them with a comprehensive collection of oscillograms of arcing under a wide range of conditions and they have devoted considerable attention to the study of their voltage characteristics. They find, for example, that after corrections have been made for other effects, the arc-voltage record of certain types of arc subjected to fluctuating mechanical pressures yields a continuous record of these fluctuations; the arc thus becomes its own pressure recorder. This paper, however, deals only with the main characteristics of the arc affecting arc energy calculations in the simple case of arcing in such a large gas container that the general pressure is not materially increased thereby.

(1) The tests indicate a voltage-drop ranging from 20 to 50 with a mean of about 30 (total) at the two contact surfaces. This, multiplied by the current and arc duration, gives a measure of the energy absorbed at the contacts.

(2) Corrected 0 deg. C. and 760 mm. pressure. The authors have done a considerable amount of work on the effect of pressure on the quantity of gas evolved per kW-second of arc energy and on the effect of pressure on the composition of the gas. The work is, however, not yet ripe for report except to stata that, as suggested by Kesselring, there is a tendency for volume to increase with increase of pressure and that changes take place in the gas composition.

(3) Some proportion of this energy may, however, ultimately be used in producing gas.

A formula for arc energy when arcing takes place in gas has been developed, based on simplified assumptions arising from experiment and theory; it illustrates the great complexity, more especially of certain known features of the time and frequency factors, which may in certain circumstances play a highly important part in affecting arc length and energy production; they appear to have been omitted in the previously published formulæ of Bauer and others.

During the period between the zero pauses, when current is flowing, a certain voltage-drop is required to maintain this current across the arcing space. This total voltage-drop includes a part which is approximately constant, namely, that occurring at the contact surfaces, and another part which is proportional to the length of the arc. The expression for the arc voltage must, therefore, involve a constant term, and another which is proportional to the arc length.

The point that the authors emphasise is that the whole of that part of the voltage which depends on the length of the arc depends also on the current in the arc. With long arcs when the contact-drop becomes relatively negligible, the voltage across the arc should thus be approximately inversely proportional to the square root of the current. The authors' tests indicate, however, that for the initial stages of a power arc in gas or under oil over the range 150 to 1,500 amperes (r.m.s.) such an expression for the arc voltage does not hold.

To explain the form of the voltage wave in the neighbourhood of the current zero the characteristic must include a term depending on the current, but elsewhere in the half cycle such a term is relatively unimportant. The authors find that the *important term* involving $l$ is *independent of the current* and is simply $e_1 l$, where $e_1$ is practically equal to the voltage per unit length of arc path proper, allowance being made for the contact-drop; the new characteristic is thus of the form

$$e_a = e_c + \frac{k}{\sqrt{i}} l + e_1 l$$

in which the term involving both $l$ and $i$ is assumed to be of the same form as that given by Steinmetz. The means of the values of $e_1$(*) found by three different methods lie between 40 and 55 volts with a mean of approximately 50 volts for the authors' tests in hydrogen at approximately atmospheric pressure and over a wide range of current values. Such a difference in the arc characteristic between the earlier equations and that suggested above, leads to a considerable difference in $e_p$ to be expected over the range of currents examined, when $e_p$ is the value of the voltage per unit length of the arc path ($e_1$) in each half cycle at the instant of peak current;

$e_a$ = total instantaneous voltage ordinate across the arc as measured on oscillograms;
$e_c$ = total voltage-drop at contacts;
$e_1$ = instantaneous voltage per unit length of arc proper $[= (e_a - e_c)/l]$;
$i$ = instantaneous current flowing in arc;
$l$ = distance between contacts drawing arc;
$k$ = constant.

Norberg would lead us to expect a change of the order of 3 to 1 between the mean values of $e_p$ observed in the tests at 140 and 1,600 amperes (r.m.s.), whereas no such difference is observed, the mean values over the range mentioned differing little, if any, for a series of tests in hydrogen. The authors carried out a larger number of tests in *oil* over about the same range of currents as that mentioned above, and they also showed no change in the mean arc voltage.

To explain the form of the earlier equation the arc is considered to be a highly conducting cylinder, of cross-sectional area proportional to the current, surrounded by a sheath in which energy is dissipated. This energy, being proportional to the surface, would be proportional to $\sqrt{i}$, and the corresponding voltage would consequently be proportional to $1/\sqrt{i}$. It seems that in this treatment, except at small currents, the importance of the sheath is being stressed at the expense of that of the conducting core. The core is, however, the important feature at higher currents, and since the cross-sectional area of the core is proportional to the current, the specific resistance of the arc path apparently remains unchanged at different currents and we should therefore expect the required voltage also to remain unchanged. Conductivity has, as it were, reached an optimum condition, and no further reduction of voltage occurs as the current is increased.

The important factors connected with a power arc are thus the instantaneous voltage per unit length of the arc ($e_1$) and the critical gap ($l_c$) which the voltage available at zero current is just insufficient to break down. It will seldom be the full length of the arc, as the chances are that it will be reached in the middle of a half cycle, in which case arcing will continue to the end of that half cycle, when, if the conditions have remained the same, the arc will go out. Were $l_c$ and $e_1$ to remain unaffected by speed of break, there would be a best speed of break corresponding to the frequency of the system, resulting in least energy liberation in the arc. So far as the authors' experiments go, the optimum speed is not very critical, and the designer has reached appropriate figures in most cases, but their observations clearly show that high speed *per se* is not necessarily good as had been generally supposed and as would be inferred, for example, from Norberg's formula.

(*) Treating the term involving $\sqrt{i}$ as negligible.

If the contacts could be mechanically widely separated just at the moment when the current becomes zero, and so far that the arc could not re-strike, the problem would be solved, as at zero current the energy stored in the magnetic field is zero. In circuit breakers as usually constructed, very large amounts of energy are released in the opening process; if only the arc were interfered with sufficiently while the current is heavy, almost the whole energy of the generator and circuit might in fact be made to appear in the switch tank. Magnetic blow-outs and other forms of electromagnetic acceleration have been effective, but have to be justified in each particular case; they are not a panacea.

We have now reached the stage where we can deal with shortening the critical arc length by cooling gas blasts. Lengthening the arc beyond the critical length, unless accompanied by a sufficient decrease in arc duration, is, in general, bad, as it tends to create unnecessary energy release between the contacts, which makes cooling more difficult at the zero pause. It is therefore important to direct the cooling gas blast in such a way that it cannot produce such a lengthening of the arc between the contacts as would happen if the blast were applied laterally to the whole path, or if it came in through or around one contact and escaped radially outwards into the arcing vessel.

Excellent results were obtained with apparatus in which the arc could be drawn in about 0.01 sec. to a distance of about ¾ in. between a socket electrode forming the throat of a venting passage and a plug electrode forming the head of the moving contact. The arc was subjected to a powerful blast of gas which was guided so that it passed over the arcing surface on the plug electrode and flowed in the general direction of the arc axis into the throat of the venting electrode, thus scouring the whole of the arc path between the electrodes while preventing the arc from looping or extending in any direction. Any tendency of the arc to extend up the venting passage by looping was prevented by the surrounding walls, which were at the potential of the venting electrode and were so near together that they short-circuited any portion of the arc which began to loop. Arcs at 5,500 volts can be extinguished by blasts of hydrogen, air, or other gases in the theoretical minimum time (which varies from ½ to 1 cycle according to the current asymmetry) with great regularity at all currents available with the test generator at Newcastle (7,000 amperes, peak) in air with a single gap never exceeding ¾ in., and upwards of 15 to 20 repeat tests in a highly inductive circuit with currents of from 1,000 to 3,000 amperes have been made without attention to the contacts. The tests have been so uniformly successful that the authors have now built a larger model for three-phase operation at much larger power. As arcs can be broken in gas without the presence of oil, what is the function of oil in an oil circuit-breaker? A brief indication of the answer is as follows:—

(i) *Disadvantages.*—Oil introduces such factors as local gas production, surging, fortuitous contact of oil with the hot arc crater, or the arc itself, &c., which are difficult to control in ways which may assist and not hinder arc quenching; also the fire risk.

(ii) *Advantages.*—Amongst them are the breaking up of the oil by the arc resulting in the presence of hydrogen gas, which has much better cooling properties than air. The oil effectively insulates the contacts from each other and from earth after the arc has gone out, and reduced internal clearances are possible owing to the relatively high electric strength of oil. It presents a cooling and condensing surface closer to the arc than would be safe with unprotected insulated surfaces in like situations, which rapidly lose their insulating properties by becoming covered with deposited copper.

Thus the presence of the oil introduces a number of new and important factors which may have bad or good effects, according to the way in which they are controlled by the designer. The authors have shown how they can be controlled when gas alone is used; they propose in their next paper to show how control can be exercised in the more complex case of arcing in oil.

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### Discussion in London.

Mr. W. A. COATES remarked that the paper was a novelty inasmuch as the tests it described were truly comprehensive and had been carried out in a scientific manner. Mr. Wedmore had life-long experience of circuit-breaker design, Mr. Whitney was an ingenious physicist, and Mr. Bruce a capable mathematician; the industry was indebted to them, not only for the results of their research, but also for having devised much novel testing apparatus and methods which would, no doubt, be used in future by the more wealthy manufacturers for obtaining corresponding check data. It would be dangerous to criticise, or form conclusions, at the present stage of the work: but at a first glance the new equation might be con-

sidered a justification of the multi-break switch. However, that argument was not a good one, as that class of switch was not commercial except for high voltage. The tests hinted that the circuit breaker as built to-day was, if anything, a little worse than the explosion-pot (or snap) switch. It must not be assumed as a result of the investigation that present types of gear would be scrapped immediately; the art of design would, however, now be given a scientific basis.

Mr. H. W. CLOTHIER, though commending the paper, thought it delicately avoided the practical issue of the day. The air-break switch described therein could only be regarded as a device wherewith to obtain data, for oil immersion must be retained however cleverly the arc was "caught out." The oil was an essential arc stopper, and prevented the arc spreading in the event of insulation failure; otherwise the circuit breaker would become a furnace. If the authors' work had done anything, it had abolished the thin-sided tank, which had yielded too much to pressure. It was to be hoped that their facilities would not for long remain limited by the amount of power at their disposal. Was it not possible for the explosion-pot to exceed the speed limit? The multi-series-break switch was easier to insulate than the explosion-pot pattern. He exhibited lantern slides to indicate what some manufacturers were doing hand-in-hand with the investigations described in the paper: they depicted metal-clad air-break switches incorporating plunger mechanism that caused air streams to puff on to the contact points, thus tending to extinguish the arc. Such devices would, however, never become practical, as they could not dispense with the oil, which guarded against insulation failure. Other slides indicated the primitive tests that were resorted to; they would have to find something better than was now available in that respect. For instance, a tank which had been subjected to a 250 lb. per sq. in. hydraulic test, was buried in a pit in the ground and 27 oz. of black gun powder exploded within it; a pressure of 2,000 lb. sq. in. was recorded, but the tank withstood it.

Dr. C. C. GARRARD pointed out that the paper was one of those which answered the question whether research paid for itself. They should differentiate between invention and research, for the former became possible only after the latter had made all the facts and conditions known. The more such papers were published, the better it would be for all concerned, because if the information were buried in reports that were accessible only to the few, it would be lost. In the case of any electrical mechanism, 90 per cent. of its success depended upon its mechanical design, which should accordingly be as simple as possible. So far as he had studied it, he had been unable to apply the new formula to 2- and 4-break switches. Was the arc energy the proper criterion of a circuit breaker's capability? Large gear which had done well on large current had failed on small current. He was of the opinion that all disasters had been due to the explosion of gas accumulated in the air space above the oil level in the tank, the energy of which would be greater than that of the arc which formed the gas.

Mr. W. WILSON thought the authors' ingenious test methods would be an incentive to others to improve their own. The statement that the arc was not extinguished by the oil was an unhappy expression, and, indeed, not quite accurate. Arc extension was the same in air, in a liquid, and even in a solid conductor; one surrounding medium extinguished an arc more readily than another simply because of its superior heat absorption. With the aid of lantern slides made from photographs taken with a high-speed repeating camera, he explained his contention that an arc was not snapped off, but "faded out" throughout its whole length. An a.c. arc's temperature would be falling rapidly at the zero current point, and it would accordingly be at a disadvantage just then.

Mr. P. D. MORGAN, referring to magnetic blow-out, asked if anyone had tried to blow out an arc in one phase with the current in the other two phases? Preliminary calculation seemed to indicate a puff effect which would be greater with such an arrangement than if the current in the arcing phase alone were employed. Arc photographs might easily be misleading, for it was difficult to distinguish smoke and vapour from the arc itself.

Mr. E. B. WEDMORE, in reply, suggested that their first paper might be likened to the *hors d'œuvre*, and the present one merely to the soup, so that there must be the substantial courses before they could crack the nuts. With regard to mechanical strength, or factor of ignorance, whichever they liked to term it, they had reached the zero pause and were looking round for patents before launching out in a fresh direction. The results they had already obtained would lie fallow until they could obtain more power with which to continue the work. At any rate, the gas-blast switch did behave according to plan, which was more than could be said of the circuit breaker. Arc energy was only a tool, but one of precision, and accurate results were consequently obtainable from its use.

# The Relation between Electricity and Coal Utilisation.

**An attempt to estimate the nature of the fuel requirements of the future and the steps that need to be taken to meet them.**

DEALING with some of the "Potential Relations between Electricity and Coal Utilisation" in a paper he submitted to the second International Conference on Bituminous Coal, which was recently held at Pittsburgh, U.S.A., Mr. A. T. Stuart, consulting engineer, of Toronto, Canada, concluded that solid fuels would largely disappear from the market and that demands would be almost exclusively for gaseous and readily gasifiable liquid fuels.

Such fuels contained up to five times the amount of hydrogen contained in coal, and, therefore, to produce the desired fluid fuels without by-products and without losses it would be necessary to decompose a vast quantity of water in order to obtain the necessary hydrogen. In fact, it was not unlikely that more water than coal would be used as the raw material and that perhaps half the energy of future fuel would come from the combustion of hydrogen obtained originally from water. The decomposition of such a quantity of water would release far more oxygen for coal processing, since the hydrogen requirements must in any case come from water already yielding a large surplus of oxygen. The further increase of the surplus would result in an overbalanced production of oxygenated products, such as carbon-monoxide gas, methanol, &c., unless a second process were introduced to restore the balance by reducing oxygenated material to hydrogenated products.

For the ideal processes the only materials used would be coal and water; all the products would be desirable, none of them by-products, and none would escape as flue gas. The ideal could be attained only by decomposing water in such a way that hydrogen and oxygen would be separated and directed into proper channels, where each would be used to the best advantage in the processing of coal and in the utilisation of coal products. In order to conserve coal, to keep coal requirements down to the minimum, and to produce only the desired end-products in desirable proportions, only a part of the required water could be decomposed by usual methods and perhaps half must be decomposed by electricity. It was therefore concluded that coal processing would centre about water-power plant, the entire output of which, in some cases, would not be electricity, but hydrogen and oxygen as already exemplified in the case of certain nitrogen products—notably that of the 125,000-h.p. plant of the Norwegian Hydro-Electric Nitrogen Corporation. In many such cases the hydrogen values would be sufficiently high alone to make operation profitable, so that oxygen would be obtained at no cost, a circumstance which further precluded the use of air as a source of oxygen.

A complementary electrical problem concerned means of developing 100 per cent. load factors in operating plant and means of utilising latent power resources not now in demand. Accordingly circumstances would be favourable for simultaneously solving problems relating to both coal and power in such a way that both coal and electricity would be used jointly in the one process of making fluid fuels. Thereby the highest degree of efficiency in utilisation would be effected in each case and, instead of being competitive as at present, the two sources of energy, the one potential and the other kinetic, would co-operate to the greatest general advantage.

Mr. Stuart pointed out also that a complementary problem of the electrical industry was indicated by the facts that:—

1. In North America alone some $20,000,000,000 was invested in enterprises supplying electricity in a market capable of absorbing only about half of the possible output.
2. In North America there remained undeveloped some 75,000,000 maximum horse-power in water power.
3. There were many sites where steam power could be developed at costs comparable with those of water power if use could be made of the output.
4. Similar conditions existed throughout the world.

Those facts seemed to indicate, first, that there was a wide field for the cultivation of new uses for power in order to establish 100 per cent. load factors of existing plant, and, secondly, in order to draw upon undeveloped resources in energy. The opportunities lay in devising methods so that electricity could be made to co-operate with coal in providing the fuels of the future and means of perfecting their use.

It would be difficult, if not impossible, to name any other vehicle than the electrolytic cell for meeting all the requirements of the case. It could be automatically operated in small space at high efficiency and at a capital cost of only a few dollars per h.p., all the operating costs totalling less than $5 per h.p. year. Such costs meant less than 5 cents per thousand cubic feet of hydrogen and oxygen gas, to which power added 1.1 cent for each $1 cost per h.p. year. In the case of hydro-electric power-plant having surplus water there might be no extra costs for using off-peak capacity and such power companies could produce the gases at about 5 cents. Similarly, power companies operating steam plant could utilise surplus capacity at virtually the cost of extra coal only and produce the gases at less than 25 cents. As for the use of continuous power at water-power sites, all costs should average round about 20 cents. If all those costs were imposed on hydrogen, the figures would vary from 8 to 38 cents and oxygen would bear no cost whatever.

To the large-scale electrolysis of water an analogy was the electric steam boiler, operated in Canada at a total capacity of 750,000 h.p. Although the demand for steam was narrowly restricted, largely to paper mills, and although the value of the power so used was only about $7 per h.p., it was said that "this invention has made possible the development of the Gatineau and Saguenay Rivers." If that were true, then the electrical industry had a lot to look forward to in the electrolysis of water, instead of boiling it, in order to supply hydrogen and oxygen gases for the processing of coal.

To-day kinetic energy, *i.e.*, electricity, completed with potential energy in the form of solid, liquid, and gaseous fuels, and in many cases such competition was already quite keen: for instance, motor cars and 'buses competed severely with electric street cars and suburban electric railways, and domestic gas competed with the domestic uses of electricity. In view of recent developments it was not unreasonable to expect that gas might be delivered at such costs that it would compete with solid fuels and become the form of fuel in universal demand. The delivery of gas at such low costs would be bound to affect seriously the sale of electricity for a great variety of domestic, industrial, and municipal purposes. It was possible that, in the future, it might be considered most undesirable to use "raw electricity" just as it was now considered undesirable to burn "raw coal." Just as coal was being looked upon more and more as a raw material for the manufacture of raw products, so electricity might come to be looked upon as a raw form of elusive kinetic energy which should be harnessed in some way. The opportunity to do that, the author maintained, was offered in the form of the application of electricity with coal to the production of gases and liquid fuels at low cost.

# New Electrical Devices, Fittings, and Plant.

**Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.**

### A New Lighting Fitting.

A recent addition to the range of "Supastone" electric lighting fittings of the WHOLESALE FITTINGS CO., LTD., 23, 25, 27 & 37, Commercial Street, E.C.1, is the "Supa-Model," fig. 1. The design of the unit is based on the correct optical combination of three cylindrical reflectors made from "Supastone" three-ply glass. The maximum light intensity is projected downwards, while ample illumination is provided for the surrounding walls, ceiling, and so on. The location of the lampholder is adjustable, so as to ensure the correct position of the lamp, and the construction permits of adequate cooling. Further claims for the fitting are that it is artistic, easily cleaned, and particularly suitable for schools, banks, public buildings, and so on.

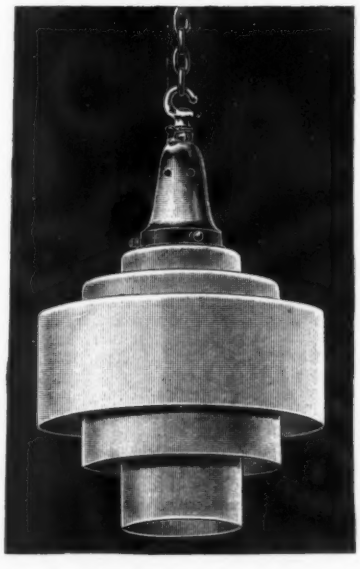

**Fig. 1.—The "Supa-Model" E.L. Fitting.**

### An Improved Measuring Instrument.

We have previously described in these columns the "Avometer," a high-class combination electrical measuring instrument sold by the AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD., "Winder House," Rochester Row, S.W.1. A new model (1928) of the instrument has recently been introduced which embodies some new features. The instrument ranges have been considerably increased, the new limits being: Current, 0.1 mA to 12 A; pressure, 1 mV to 1,200 V; resistance, 0.1 ohm to 1 megohm. The dial is marked with two scales, each 5 in. long, the upper one, 1,000-0, being used for all resistance tests, while the lower one, 0-120, is used for current and voltage indications. The dial is provided with an untarnishable mirror to prevent parallax errors. A single switch governs all the ranges, and is fitted with a spring click which operates at each position. The bakelite front fits into an attractively finished strong aluminium case, the joint being completely dust-proof. In the back of the case is a compartment for holding a single dry cell (1.5 V) which is connected in the ohmmeter circuit for the two lower ranges. A quick and easy method is provided for checking and, if necessary, compensating for any variation in battery voltage or resistance.

### A "Washing-up" Machine.

An electrically-driven machine designed for washing dishes, cooking utensils, and so on, in such establishments as boarding houses and small hotels, is the "Silent Gem" washing-up machine, fig. 2, introduced by the WASHING-UP MACHINE CO., LTD., 34, Fulham Road, S.W.3. It is claimed to be very effective in its work, require little or no attention, have a high efficiency, and to be silent in operation. It is also claimed to be impossible to break the articles while washing-up. The machine has two compartments, one for washing, and one for rinsing. It is constructed of electro-plated castings and sheet-metal, made of a non-rusting polished material, composed chiefly of pure nickel and copper. It can be heated electrically by 500-W immersion heaters. The principle of operation is the rapid circulation of the fluids passing through the articles, and these are stacked so that each one receives the full pressure. The machine is 2 ft. 3 in. high, 2 ft. wide (without dip trays), and 1 ft. 2 in. back to front. It is driven by a ¼-h.p. motor.

**Fig. 2.—The "Silent Gem" Washing-up Machine.**

### A Small Generator Driving Unit.

The "Marconi" 1-h.p. petrol engine recently introduced by Messrs. Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2, has been designed for driving small electrical generators, and is employed as the prime mover for a number of Marconi wireless sets used in connection with military field wireless stations, ground testing for aircraft wireless equipments, and emergency landing equipment for aircraft wireless equipments. In each case a special bedplate is supplied, together with a flexible coupling suitable for the particular type of generator, or the engine can be supplied separately if required. It operates on the two-stroke principle, is air cooled, and combines lightness, portability and compactness with robust construction. All the bearing surfaces are generously proportioned, and by the use of special aluminium alloys, the weight of the reciprocating parts has been reduced to a minimum, thus permitting high speed without undue vibration and consequent wear. By loosening only one nut, the cylinder head, cylinder, piston, gudgeon pin, magneto and carburettor may be removed from the set, and it is possible, it is claimed, to dismantle and replace all these parts within five minutes. Cooling is effected by a cowled centrifugal fan incorporated in the fly-wheel, cold air being drawn over the generator through the fan and a forced draught directed upon the cylinder head. The lubrication is automatic and governed by the varying crankcase pressures.

### A New Switch-Fuse.

The "Simplex Splitter" switch-fuse, a new product of Simplex Conduits, Ltd., Garrison Lane, Birmingham, has been designed to meet in an inexpensive way the requirements

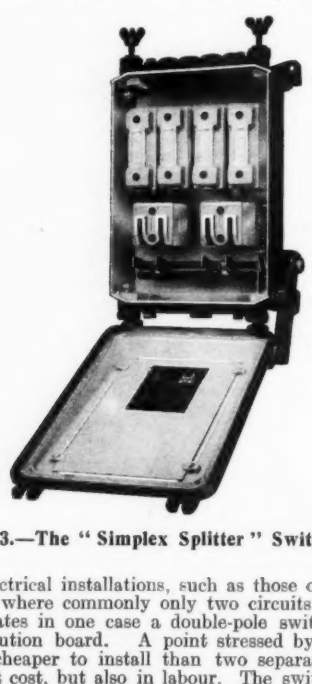

**Fig. 3.—The "Simplex Splitter" Switch-Fuse.**

of small electrical installations, such as those of houses, flats, and so on, where commonly only two circuits are necessary. It incorporates in one case a double-pole switch and a two-way distribution board. A point stressed by the makers is that it is cheaper to install than two separate articles, not only in first cost, but also in labour. The switch-fuse, fig. 3, is made in two sizes, both for 250-V circuits; one has both the switch and fuses rated at 15 A, and in the other the switch is rated at 45 A and the fuses at 25 A.

### Telephone Humour.

The following appeared in the *Western Mail* recently:—It is not often that we find our dignified Government departments breaking out into humour, but, consciously or unconsciously, they have done so in the latest issue of the "Cardiff Telephone Directory." On page 68 appear two advertisements:—

J. SUMMERS & SON,
FUNERAL DIRECTORS,
MOTOR HEARSE and FUNERAL
CARRIAGE MASTERS,
.....
.....

WHY NOT CONVERSE WITH
YOUR
*DISTANT* FRIENDS?
Trunk Charges are Reduced by
about One Quarter after 2.0 p.m.,
and One Half after 7.0 p.m.

Who, after this, would dare suggest our Post Office is not up to date?

# Parliamentary News.

[By Our Special Parliamentary Correspondent.]

### The Adjournment.

Parliament adjourned for the Christmas Recess on Wednesday, December 20th, and will reassemble on Tuesday, January 22nd.

### Electricity Supply Bill, 1928.

This Bill, which amends the compensation clause of the 1919 Act, has passed through all its stages, and has received the Royal Assent.

### The "Grid."

On December 18th, Sir Douglas Newton asked the Minister of Transport how many miles of main grid transmission lines had been erected during the current year; and how many miles in England and Wales since the passage of the Electricity (Supply) Act of 1926.

Colonel Ashley said he was informed by the Central Electricity Board that contracts had been let for approximately 246 miles of grid main line transmission in Scotland, and 550 miles in South-East England. The erection of the line had been commenced on two routes in Scotland—52 miles in length—and on one route in England—10 miles in length.

### The New B.B.C. Premises.

On December 18th, Mr. Malone asked the Postmaster-General whether the British Broadcasting Corporation obtained his approval before deciding on the purchase of new premises; and, if so, whether the question of a national opera house as part of the scheme was considered.

Sir W. Mitchell-Thomson replied that this matter was dealt with by the British Broadcasting Corporation under the general powers which had been conferred upon it, and it was not necessary to obtain his approval. The second part of the question did not therefore arise.

### The Cost of the "Beam" System.

On December 19th, Sir W. Mitchell-Thomson informed Mr. Wellock that the total capital cost to the Post Office of the four Imperial beam wireless services was approximately £242,200. There was an annual royalty payable to the Marconi Company so long as any of its patents were employed in the stations.

### Artificial Sunlight Centres.

On December 19th, Sir Robert Thomas asked the Minister of Health whether he was aware that at the end of last year there were only 183 centres equipped for administering artificial sunlight treatment; and, in view of the fact that 53 per cent. of the children of the nation were authoritatively stated to be suffering from rickets or its effects, would he take steps towards equipping more centres.

Sir Kingsley Wood said that there were 237 centres of this kind approved by the Ministry of Health or the Board of Education for artificial light treatment. The establishment of such centres was primarily a matter for the local authorities, and steady progress was being made with the provision of these facilities.

### The Scientific Treatment of Coal.

On December 19th, Major Owen asked if the Government would consider the appointment of a small temporary commission to arrange for the co-ordination of research into the most scientific utilisation of coal; and whether it was now possible to make such utilisation of coal a commercial proposition to be dealt with by the Government in the same way as the production of hydro-electric power or, alternatively, by the creation of a national corporation.

Commodore King said that the Fuel Research Board of the Department of Scientific and Industrial Research was already conducting research into fuel economy questions and giving technical advice to other investigators of those problems wherever possible. Any attempt at closer co-ordination of private research would, in his opinion, do more harm than good. He was not prepared to express an opinion about the commercial possibilities of the numerous new processes now under investigation.

### Electric Traffic Signals.

On December 20th, Sir Nicholas Grattan-Doyle asked the Home Secretary whether any automatic electrically-controlled traffic signals were in operation in the Metropolitan police district; and, if they had not yet been introduced, whether, having regard to the small cost as compared with the cost of police control, he would consider introducing them.

Capt. Margesson, who replied, said that electric light signals were and had been for a considerable time in use in Piccadilly. They were not, however, automatic in the sense that police control could be dispensed with. The question of experiments with automatic signals was under active consideration, and the result of any such experiments must be awaited before it was possible to decide whether police control could be eliminated or reduced by such means.

# Overhead Lines Association.

## A General Discussion on the Subject of Power Line Insulators.

A MEETING of the Overhead Lines Association was held at the Institution of Electrical Engineers, London, on Wednesday, December 19th, Mr. W. Fennell (president) in the chair.

In opening a discussion on "Insulators," Mr. C. W. MARSHALL gave a brief account of the manufacture of porcelain for insulators, and mentioned that the commonest types of insulators were the cap and pin, the Hewlett, the Jeffery Dewitt, and the Motor, the first-named being most commonly used, and having the outstanding advantages of a high degree of reliability and comparatively low cost. The disadvantages were uncertainty of uniformity of quality, due to the occasional unreliability of the pin-fastening methods, and relatively low puncture strength. The Hewlett insulator was expensive, gave an inferior voltage distribution curve and a lower flash-over voltage, and was liable to cascading; it was probably the most difficult of all types to manufacture really well. At the same time, it had been an outstanding success when made satisfactorily and applied under suitable conditions. The Jeffery Dewitt insulator was greatly favoured by some American transmission engineers, its puncture strength and ruggedness being points in its favour, although these advantages did not appear to justify its higher cost. The Motor insulator in its present form was a comparatively recent innovation, but was really a development of the stem insulator used by Dr. Ferranti about 30 years ago. It was strong mechanically, although it used porcelain in tension, which was contrary to the doctrines instilled by most teachers of electrical engineering. It was almost puncture proof.

Referring to the effect of salt deposit on insulators, Mr. MARSHALL spoke of the happenings in this country during the storm of 1927, when many insulators, especially near the coast, were coated with a salt deposit which caused serious interruptions to the supply. Similar troubles had been experienced in the coastal regions of Morocco and California, and the explanation given as the result of investigations was that the salt-laden air caused a layer of conducting material to form on the insulators, and breakdown took place. To overcome the difficulty from salt and fog-laden air on the Moroccan coast a special type of oil-filled insulator had been developed which, it was claimed, gave satisfactory results. At the same time the oil bath insulator required refilling with oil at fairly frequent intervals due to the shaking-out of the oil and the filling-up of the oil reservoir with dirt, and therefore the success of this type of insulator was a matter of balancing the cost of washing the ordinary type of insulator against the cost of washing and refilling with oil in the case of the oil-filled type. The Lapp anti-fog suspension type of insulator had been developed to meet the atmospheric conditions on the Pacific coast and such districts as Pittsburgh, the object being to avoid having large areas of low resistance in series with small areas of high resistance. The wet-soot flash-over of an insulator chain of the anti-fog type was about double that of an equivalent chain of standard cap and pin insulators. He understood that the Germans had developed special insulators for use on the coast of Palestine, where the conditions were said to be as bad as those on the coast of Morocco.

Dealing with the subject of insulator testing, Mr. MARSHALL remarked that, due to the incomplete state of our knowledge of the stresses to which insulators were subjected in practical service, the tests now applied to establish soundness were of a very empirical nature. The degree to which insulators should be stressed was largely a matter of experience. The puncture strength of an insulator was usually determined by applying electric pressure to it when immersed in an oil bath, usually at normal voltage. In service, however, punctures were mostly caused by high-frequency or impulsive stresses, and to determine the properties of insulators under such conditions an impulse test was used which consisted of suddenly applying a high degree of stress by discharging a condenser through the insulator undergoing test. Standard impulse tests had not yet been developed, but sufficient experience had been gained to make it certain that such tests gave a very useful measure of the quality of an insulator.

High-frequency tests were made by "flashing-over" in air at a frequency of the order of 200,000 cycles per second. This test was useful for revealing surface defects, such as cracks in the glazing, but it had a decided tendency to damage sound insulators by overheating them. A "thermal" cycle test was usually made on insulators used for outdoor work. This test consisted of immersing the insulators alternately in hot and cold water, the temperature range being of the order of 70 to 80 deg. C. Porosity tests were made by subjecting broken pieces of porcelain to high hydraulic pressure, using a fuchsine solution as an indicator of the depth of penetration.

Chains of insulators were tested by determining their dry and wet flash-over voltages. The dry flash-over test was hardly more than a measurement of the dielectric strength of air; the wet flash-over test was more useful, but great care had to be taken in making it if trustworthy results were to be obtained.

A question had been put to him, said Mr. MARSHALL, as to the possibility of a shortage of insulators through manufacturers of ordinary porcelain not being able to manufacture electrical porcelain. They should, he thought, be able to manufacture it in time, but he did not anticipate the development of standardised methods of manufacture which would enable ordinary manufacturers of porcelain to change over without considerable study of the whole conditions.

The cap and pin insulator was the best for general service, although there was still a difficulty in fixing the pin. One firm used screws, and another cement, whilst yet another used a metallic fixing. The only certain test as to which was the best was time. In many cases cemented insulators had given excellent results over a period of four or five years, and then cracking trouble had set in. The supporters of metallic fixing claimed to have eliminated this trouble. The oil-filled insulator had given a longer period of peace from line repairs, although he could not say that it appealed to him.

Major THEODORE RICH regretted that we did not possess in this country a laboratory for testing insulators, such as that owned by the Ohio Brass Co. in America or the Electro-Céramique in Paris. As this country intended to spend an enormous sum of money on the erection of the "grid" lines, it would pay the Government to spend some money also in assisting manufacturers of insulators to provide the necessary testing facilities. In France there were probably three glass insulators made for every one of porcelain, but glass did not seem to have made very much progress in Germany, although the "Pyrex" people had done a certain amount of work. Up to the present efforts to make insulators of powdered material, such as Bakelite, had not been successful, but it seemed that insulators which could be made of a moulded material would not be so liable to break or so vulnerable to stone-throwing.

Mr. COCKBAIN said that the trouble of cascading with the Hewlett insulator had now been completely overcome. As to the trouble with cement for fixing pins, he believed it was due to the cement not being true Portland cement. One great fear of insulator manufacturers with the Lapp type of insulator was the ratio of spark-over to puncture voltages, which was reduced owing to the increase of leakage path which was possible.

Mr. A. C. DUNLAP mentioned the use of Bakelised wood for the cross arms and insulator pins as having completely overcome the troubles on the Moroccan coast due to the salt-laden air, and he gave some results of tests carried out in this connection at Nancy University. The tensile strength of Bakelised wood was roughly three times that of untreated wood, and although it was not non-inflammable, it was difficult to set it alight. Further, it was not an expensive product. Bakelised wood was simply wood impregnated with Bakelite varnish.

Mr. C. S. GARLAND said that in connection with a porcelain factory which he was erecting it was proposed to erect a testing laboratory capable of testing at up to one million volts, and any assistance from the Government would be most welcome. As to steatite, it had a very much higher tensile strength than porcelain, and the success of the Motor insulator had been largely due to the use of steatite. In some of the German factories it was the practice to use X-rays to investigate the condition of porcelain and to ascertain if there were any undue stresses.

Mr. C. D. KING said there existed in this country a laboratory for the high-voltage testing of insulators which was at the disposal of anybody desiring to make use of it, and the Secretary of the Association would put those interested in communication with the right quarters.

Mr. HARBER said that glass had an electrical resistance approaching infinity. Moreover, it was much better mechanically than porcelain.

Mr. COCKBAIN said it was undesirable to use porcelain in tension. In comparing glass with porcelain, the outstanding requirement was the ability to withstand inherent stress, and as time went on it was apparent that inherent stress would become more severe. He believed there was a laboratory at Teddington with plant for testing up to one million volts, and instead of the Government supplying funds for the establishment of similar laboratories by manufacturers, he felt that all the facilities of this nature should be concentrated at one centre, such as Teddington.

Mr. ERLEBACH said the Hewlett insulator was introduced because there was trouble with the cementing of the cap and pin type, but he believed the leading makers had got over the trouble with cementing, having found that the fault lay not with the cement but with the method of application. So much improvement had been made in this direction that he knew of a recent case in which the purchaser of some switchgear specified that certain cementing in connection with it should be done by insulator makers.

Mr. ANDERSEN suggested that they should aim at simplicity in insulator design and stick to the cap and pin type; not only was this the most economical, it was also the best engineering job.

The President remarked that when he had trouble with his insulators during the brine storm of 1927, he sent some of them to the British Engineering Standards Committee, which apparently found no difficulty in having them tested. He did not think there had been any suggestion by Mr. Marshall that the Government should assist manufacturers to build their factories, and he felt it was important that they should have an independent testing laboratory in order to check the figures given by the manufacturers. Some hundreds of Hewlett insulators had been in use for four or five years on his system and had given very little trouble; indeed, they did not break down during the brine storm, although the pin insulators did. He had been hoping that insulator manufacturers would be able to produce an insulator that did not need washing, because with the increase of the load on the stations, which would mean that Sunday morning would be taken up with the cooking load, and the afternoon with radiators, whilst the water heating load would be on all night, he failed to see where the opportunity would come to carry out the washing operations. It was to be hoped that something would develop out of the use of Bakelised wood. It seemed to him likely to lead to a revolution if they could manufacture the complete insulator of that material.

Mr. Marshall, in replying to the discussion, said it had always been a matter of regret to him that the Continental people were so far ahead with regard to testing facilities, which had enabled them already to compile exact data regarding the performance of insulators. Steatite was a magnesium silicate instead of an aluminium silicate, which was the ordinary porcelain, and it was undoubtedly a remarkable product with excellent mechanical properties.

The Chairman, proposing a vote of thanks to Mr. Marshall, said he felt considerably happier now that it had been made apparent that insulators in this country would be designed with regard to the particular local conditions. At one time he had rather felt that there was to be a sort of mass production for the "grid" system, irrespective of local conditions.

# Faraday's Diary.

THE annual David Lloyd Roberts Lecture was delivered at the house of the Royal Society of Medicine on November 29th by Sir William Bragg, F.R.S., who took for his subject the manuscript diary of Faraday at the Royal Institution. Lord Dawson of Penn presided.

Sir William Bragg said that Faraday's diary possessed an extraordinary fascination for the student of science; it contained a million words, and the writing was of the fine, delicate character of the early Victorian period. It was interesting first because of the tremendous consequences of Faraday's work upon modern activity. In a world which was drawn together by means of communication based upon Faraday's discoveries, which had learned from him how to use electricity as a tool, which had founded great industries on the laws of electrochemistry which he had elucidated, and had based its conceptions of Nature's forces upon a unity which he was the first experimentally to establish, this account of his researches must be invaluable. But the diary was no mere record of experimental arrangements and observations. It was Faraday's custom before he planned an experiment to write down all that he thought he might attempt and perhaps observe. The course of the work altered as he proceeded, but at least he would train his perception by previous consideration to estimate at its true value that which he was about to see. When the experiment was proceeding he stopped to think, and most fortunately for posterity, put his reflection in writing—puzzled perhaps by some unexpected development, hindered by some failure or inefficiency in his apparatus, but delighted when he made a point. Sir William Bragg threw on the screen a view of a famous page of the diary, which related how, having tried hundreds of experiments for a fortnight, he had suddenly succeeded, and the "But," capitalised and underlined, which marked the beginning of the paragraph announcing his success, was a delight to look at, even after the lapse of a hundred years. That was a memorable result, too, for it established for the first time a connection between magnetism and light, the appreciation of which was vital to the understanding of those electromagnetic theories on which so much of modern science was built, and from which so many industries had sprung.

The great purpose of Faraday, said the lecturer, was to prove the unity of nature. He had a feeling that gravity, electricity, magnetism, chemical action, cohesion, light, and heat were all connected with one another, and that their activities were interchangeable. Some of the connections he succeeded in proving and describing, others he failed to establish, though he declared his conviction that they existed, and later work, using knowledge he could not possess, and apparatus far more powerful than he was able to command, had verified his belief. If we owed to Faraday, said the lecturer in conclusion, the greater part of all those developments of electricity and magnetism which had made our modern world what it was, perhaps these things, after all, did not constitute the greatest debt. He had laid the world under the greatest obligation, not for his experiments, but for the spirit in which he made them.

# Correspondence.

***Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.***

### Copper-Cadmium Conductors.

I have seen the article on copper-cadmium conductors in your issues of December 7th and 14th, and apparently it is by the same author as an identical article by Mr. N. P. Budgen, published in the *Electrician* of April 30th, 1926.

The information then given led me to think that this alloy might be an ideal material for flexible current-carrying parts of switchgear, such as the brushes of circuit breakers. On approaching the suppliers I was informed that it was impossible to obtain the conductivities given in actual practice, and the best they could do was 80 per cent. for 0.5 per cent. cadmium and 75 per cent. for 1.0 per cent. cadmium. This was still so much better than phosphor-bronze that it was decided to try the alloy.

Test samples confirmed these figures, and the 1 per cent. alloy showed only a very slight softening after half an hour at 260 deg. C.

A considerable quantity of No. 25 gauge was obtained and was found not to be as springy as the samples, and a further supply was obtained giving a scleroscope hardness of 52, which the makers considered to be the maximum possible, and a stress to produce permanent set of 29 tons per square inch.

The supplies for the next 12 months were satisfactory, and it was then thought safe to extend the use to thicker gauges. This decision immediately produced a crop of troubles, which led to further investigation and ended by limiting the use to No. 25 gauge.

It is impossible in the scope of a letter to give all the facts and figures, but very briefly, experience has shown that scleroscope tests are of little use in this connection; bending tests by machines producing set and measuring the recovery are equally useless, and the only test giving anything like consistent results is to load a strip progressively and measure the deflections up to the first indication of set.

As regards the alloy itself, very wide variations are obtained, not merely between different consignments, but even on the same strip; variations are introduced by the methods of cutting, and differences are obtained between samples delivered flat or rolled into a coil.

The variation in stress in a consignment of the same gauge is of the order of 1 to 1.5, and of different gauges may exceed 1 to 2. Samples ranging from 90 per cent. to 62 per cent. conductivity give stresses ranging from 15.8 to 26.8 tons.

Attempts to use cadmium-bronze did not yield much success, typical figures being:—

| | | | |
|---|---|---|---|
| 46/49 | per cent. | conductivity | 29 tons. |
| 38.5 | per cent. | ,, | 21 ,, |
| 37.5 | per cent. | ,, | 23 ,, |
| 36 | per cent. | ,, | 34 ,, |
| 35.5 | per cent. | ,, | 29 ,, |
| 34 | per cent. | ,, | 31 ,, |

This led to a more careful examination of phosphor bronze, and equally remarkable variations were obtained. Typical figures are:—

2 per cent. tin, 30 per cent. conductivity 26 tons.
5 per cent. ,, 12 per cent. ,, 28 to 35 tons.

It is quite clear that a good deal more research is required on springy alloys for use in switchgear.

*For* **George Ellison,**
J. Anderson.

Perry Barr, *December 18th*, 1928.

### A Lucid Explanation!

When I find a good thing, I like to pass it on.

Dr. Schrödinger's "Four Lectures on Wave Mechanics," delivered at the Royal Institution in March last have now been published by Messrs. Blackie & Son, Ltd. The little book is written so charmingly and explicitly that I feel sure your readers who are interested in the theoretical side of their profession will like to know of it.

The gist of the whole thing is on page 12: "A simplification in the problem of the mechanical waves consists in the absence of boundary conditions. I thought the latter simplification fatal when I first attacked these questions. Being insufficiently versed in mathematics, I could not imagine how proper vibration frequencies could appear *without* boundary conditions. Later on I recognised that the more complicated form of the coefficients (*i.e.*, the potential energy of the field in terms of co-ordinates) takes charge, so to speak, of what is ordinarily brought about by boundary conditions—namely, the selection of definite values of the total energy."

In these few words, I think that Dr. Schrödinger has brought us nearer to an understanding of what electricity is than has hitherto been possible.

**John L. Dunk.**

Folkestone, *December 17th*, 1928.

### Earth or Insulate?

I regret that Mr. Gilbert should have implied that my letter contained humbug, but if the little bit of friendly and seasonable leg-pulling in which I indulged can be classed under such a severe term, then I must plead guilty.

The deep and dark secret to which he refers consists of two things—(1) the quality of the dielectric used on the flexible wire (apparently Mr. Gilbert was afraid that it was of the oil-shop variety); and (2) just ordinary common sense exercised in the details of its erection, having regard to the special working conditions of linotype machines. Apart from X-rays and psychic photography, no ordinary camera could portray these two features.

I feel sure that Mr. Gilbert will now refrain from any further hard names, and in the true Christmas spirit will shake hands over this merry little interlude, so that we can both get on with our work.

**J. M. Crowdy.**

London, *December 24th*, 1928.

[And may they both have plenty of it during the coming year!—EDS. ELEC. REV.]

# Published Specifications.

**Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.**

### 1927.

14,200. "Headlamps for motor road vehicles." F. W. V. Fitzgerald. May 27th, 1927. (301,334.)

14,303. "Joint control of the speeds of generating units in electric supply systems." British Thomson-Houston Co., Ltd. May 28th, 1926. (271,896.)

14,329. "Wireless communication." J. Robinson. May 27th, 1927. (301,436.)

14,363. "Electrodynamic loud-speakers." A. F. Sykes. May 27th, 1927. (Addition to 160,223 and 227,162.) (301,437.)

14,408. "Sound transmitting or reproducing apparatus." J. L. Baird and Baird Television Development Co., Ltd. May 28th, 1927. (301,364.)

14,656. "Electric individual drive for spinning machines with alternating-current or three-phase current machines." Siemens-Schuckertwerke Ges. (in liquidation). December 6th, 1926. (281,600.)

17,425. "Means for regulating the voltage of electrical transformers." British Electric Transformer Co., Ltd., and A. C. Whish. June 30th, 1927. (Cognate application 744/28.) (Patent of addition not granted.) (301,438.)

19,006. "Braking of moving devices or apparatus, and more particularly of winding, hoisting, hauling, and like gear." W. Eccles, J. F. Perry, J. W. Davison and Metropolitan-Vickers Electrical Co., Ltd. June 18th, 1927. (Cognate application 31,007/27.) (301,338.)

19,830. "Electric relays." W. Holmes and Ferranti, Ltd. July 26th, 1927. (301,368.)

19,869. "Method of forming electric heating units." A. E. White (Dover Manufacturing Co.). July 26th, 1927. (301,404.)

19,980. "Propulsion of railway trains or the like by electricity." P. C. Saccaggio. July 27th, 1927. (301,339.)

20,001. "Methods and means for balancing cables and land-lines." H. Tinsley and D. C. Gall. July 27th, 1927. (Addition to 262,991.) (301,340.)

22,517. "Holders for thermionic valves." E Paroussi. August 26th, 1927. (301,408.)

22,578. "High-frequency signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). August 27th, 1927. (301,352.)

22,579. "Signalling arrangements, particularly for use in telephone systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). August 27th, 1927. (301,353.)

22,581. "Electron-discharge devices." Standard Telephones and Cables, Ltd., and W. T. Gibson. August 27th, 1927. (301,355.)

22,582. "Means for reducing interference such as cross-talk in electric signal transmission systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). August 27th, 1927. (301,356.)

22,675. "Electric protective systems." A. Reyrolle & Co., Ltd., C. C. Gallop and G. H. Gardner. August 29th, 1927. (301,411.)

22,697. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennoot schap Philips' Gloeilampenfabrieken). August 29th, 1927. (301,412.)

22,762. "Microphones." H. L. Paddle. August 30th, 1927. (301,441.)

22,791. "Means for measuring electric tensions in electric transmission systems." Siemens & Halske Akt. Ges. June 18th, 1927. (292,454.)

22,884. "Electric signal receiving apparatus." Siemens Bros. & Co., Ltd., and S. H. Long. August 31st, 1927. (301,445.)

22,962. "Electric terminals." Belling & Lee, Ltd., and E. M. Lee. September 1st, 1927. (301,535.)

22,972. "Electric lighting fittings." General Electric Co., Ltd., and C. G. Eden. September 1st, 1927. (301,537.)

23,370. "Apparatus for the electrical transmission of data over comparatively long distances." Barr & Stroud, Ltd., and J. W. French. September 6th, 1927. (301,557.)

23,392. "Electric transformers." British Thomson-Houston Co., Ltd., J. G. Wellings and C. G. Mayo. September 6th, 1927. (301,558.)

23,444. "Acoustic devices." C. French and E. J. Marriott. September 6th, 1927. (301,559.)

23,522. "12-phase transformer connection, particularly for rectifier service." British Thomson-Houston Co., Ltd., and J. C. Read. September 7th, 1927. (301,509.)

23,978. "Manufacture of electron-emitting bodies." A. Lederer. April 12th, 1927. (298,561.)

24,618. "Oscillating electric fans." General Electric Co., Ltd., and J. Stanley. September 19th, 1927. (301,576.)

25,248. "Electrical condensers." Igranic Electric Co., Ltd., A. H. Curtis and W. M. Holbeach. September 24th, 1927. (301,586.)

26,635. "Vacuum tubes." Arcturus Radio Co. October 8th, 1926. (278,750.)

27,038. "Telephone and signalling systems." Siemens Bros. & Co., Ltd., and D. A Christian. October 12th, 1927. (301,597.)

27,429. "Contact plugs." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 15th, 1927. (301,601.)

27,401. "Electron discharge devices." British Thomson Houston Co., Ltd. October 20th, 1926. (279,444.)

27,987. "Spring reed for automatically winding-up electric conductors." C. R. Morton, N. D. G. Robertson and L. Smith (trading as Wayne Electrical Co.). October 21st, 1927. (301,606.)

28,240. "Circuit arrangements for preselectors of automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patteson. October 24th, 1927. (301,609.)

28,821. "Switches for direction-indicators for vehicles." R. Bosch Akt. Ges. November 15th, 1926. (280,523.)

29,169. "Means of heating liquids or fluids by electricity and electrical resistance heaters." E. Nuttall. November 1st, 1927. (Cognate application 5,073/28.) (301,617.)

29,361. "Electric-coupling elements." General Electric Co., Ltd., and F. G. Quance. November 3rd, 1927. (301,621.)

31,650. "Loud-speakers." S. G. Brown. November 24th, 1927. (301,638.)

31,893. "Electrical control gear for the alternate forward and reverse operation of electric motors." C. T. Scarf and Metropolitan-Vickers Electrical Co., Ltd. November 26th, 1927. (301,642.)

32,287. "Means for indicating the position of electric switches." Siemens and Halske Akt. Ges. March 22nd, 1927. (287,498.)

34,283. "Controlling electromagnets for lifting and transporting and apparatus therefor." K. Younghusband and J. Summers & Sons, Ltd. December 19th, 1927. (301,654.)

34,712. "Electrode for a microphone." Siemens Bros. & Co., Ltd., and G. F. Dutton. December 22nd, 1927. (301,656.)

35,106. "Circuit-breakers and similar switch apparatus for electric power current lines." O. Jacobson and A. O. Gylling. January 12th, 1927. (283,521.)

35,212. "Suspension apparatus for electric lamps or the like flex-suspended electric devices." W. Aus den Ruthen. December 29th, 1927. (301,658.)

### 1928.

55. "Electric arc welding cutting or soldering." Alloy Welding Processes, Ltd., E. H. Jones and E. J. Clarke. January 2nd, 1928. (Cognate application 988/28.) (301,660.)

403. "Prepayment mechanism for gas and electricity meters." Smith Meters, Ltd., and E. W. Smith. January 5th, 1928. (301,661.)

657. "Impulse transmitters for telephone and like systems." Siemens Bros. and Co., Ltd., and E. A Laidlaw. January 9th, 1928. (301,663.)

3,379. "Electric heaters for radiators of motor-vehicle engines." W. Elliott. February 3rd, 1928. (301,674.)

3,432. "Electric arc-welding." British Thomson-Houston Co., Ltd. February 5th, 1927. (284,714.)

4,949. "Heating elements for electric radiators." R. Frister Akt. Ges. April 27th, 1927. (289,421.)

4,372. "Electric switch." Landis & Gyr Soc. Anon. March 30th, 1927. (Patent of addition not granted.) (287,922.)

6,235. "Electrical contacts." Soc. C. Schneider et Cie. March 9th, 1927. (286,690.)

10,021. "Polyphase electric transformers." International General Electric Co., Inc. April 7th, 1927. (288,296.)

10,389. "Arrangement for the automatic control of the efficiency of transmitting systems, particularly for high frequency tranmitting systems." Siemens & Halske Akt. Ges. April 21st, 1927. (289,050.)

10,593. "Arrangement for the automatic regulation of the efficiency of high-frequency transmission systems." Siemens & Halske Akt. Ges. October 8th, 1927. (Patent of addition not granted.) (298,463.)

12,033. "Electric watches or clocks." G. Mombur. April 30th, 1927. (289,775.)

12,136. "Protection from oxidation of caps consisting of brass or similar alloys, such as bronze, for electric incandescent lamps and the like." General Electric Co., Ltd. April 27th, 1927. (289,440.)

12,391. "Means for protecting the inducing winding of a synchronous machine against an earth connection." Brown, Boveri et Cie. Akt. Ges. May 4th, 1927. (289,852.)

13,804. "Means for indicating at a distance electrically." British Thomson-Houston Co., Ltd. May 26th, 1927. (291,092.)

14,111. "Incandescent electric lampholders." International General Electric Co., Inc. May 14th, 1927. (290,577.)

14,192. "Process and apparatus for the production of ropes and cable armourings." Kabelfabrik Akt. Ges. May 14th, 1927. (290,589.)

15,571. "Incandescent gasfilled lamps and the method of manufacturing same." J. A. Kloks. May 20th, 1928. (301,709.)

15,650. "Systems of electric distribution." British Thomson-Houston Co., Ltd. June 1st, 1927. (291,404.)

16,449. "Vapour-electric rectifiers." British Thomson-Houston Co., Ltd. June 16th, 1927. (292,163.)

17,483. "Measurement of alternating-current voltages." International General Electric Co., Inc. June 16th, 1927. (292,173.)

18,396. "Manufacture of electric resistances." I. Silberstein. July 2nd, 1927. (293,304.)

19,114. "Means for indicating at a distance electrically." British Thomson-Houston Co., Ltd. July 7th, 1927. (293,459.)

19,390. "Electric switches." British Thomson-Houston Co., Ltd. July 5th, 1927. (293,393.)

26,062. "Alternating current rectifying systems." British Thomson-Houston Co., Ltd. September 12th, 1927. (297,036.)

28,440. "Cathode-ray tubes." H. E. Potts (H. Plauson). February 29th, 1928. (Divided application on 299,735.) (301,719.)

30,417. "Picture and the like telegraphy." G. M. Wright and S. B. Smith. July 27th, 1927. (Divided application on 300,148.) (301,414.)

31,205. "Weld-rods and methods of making the same." British Thomson-Houston Co., Ltd. October 27th, 1927. (299,476.)

31,629. "Protective systems." A. Reyrolle & Co., Ltd., C. C. Gallop and G. H. Gardner. August 29th, 1927. (Divided application on 301,411.) (301,447.)

31,867. "Picture and the like telegraphy." G. M. Wright and S. B. Smith. July 27th, 1927. (Divided application on 300,148.) (301,362.)

# Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from December 19th :—

Perminvar. No. 495,366. Class 6. Machinery of all kinds. No. 495,367. Class 8. Philosophical and scientific instruments and apparatus for useful purposes. No. 495,368. Class 13. Metal goods.—Electrical Research Products, Inc., 195, Broadway, New York. (British representative: F. C. Tomlins, Bush House, Aldwych, W.C.2.)

Arlita. No. 495,362. Class 8. Philosophical and scientific instruments and apparatus for useful purposes. No. 495,365. Class 13. Metal goods.—Naamlooze Vennootschap Philips' Gloeilampenfabrieken, Eindhoven, Holland. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Utilux. No. 495,806. Class 13. Chandeliers, lamp shades and supports, reflectors and electric light fittings, &c.—Louis Dernier & Hamlyn, Ltd., 23, Newman Street, W.1.

Man and Screen (design only). No. 494,702. Class 18. Electric welding apparatus.—Naamloose Vennootschap Willem Smit & Co.'s Transformatorenfabriek, Nijmegen, Holland. (British representatives: F. J. Cleveland & Co., 29, Southampton Buildings, Chancery Lane, W.C.2.)

# New Work for Contractors.

**Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.**

***Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.***

AIRDRIE.—Reconstruction and alterations at St. Margaret's Roman Catholic Church (£4,500); J. A. Reid, solicitor.

ANNAN.—Additional 24 houses for the T.C.; burgh surveyor.

BEDFORD.—Depôt extension, Britannia Road; Carter, Paterson & Co., Ltd.

BOURNEMOUTH.—Art gallery; borough engineer and Carnegie Trustees. Engineers' and electricians' shops, East Yard; borough engineer. Additions, Grange Hotel, Southbourne; Grange Hotel, Ltd.

BRADFORD.—Proposed Roman Catholic church at Thornton; rector of Our Lady of Lourdes Church. Extension and reconstruction at St. James' abattoir and wholesale meat market; ten shops, James Street; city architect, Town Hall.

BRISTOL.—Housing scheme (180), for the T.C.; L. S. McKenzie, city engineer (returnable deposit of £1).

BURTON-ON-TRENT.—Additional 22 houses for the T.C.; borough surveyor. 34 houses, Short Street site; borough engineer.

CHELMSFORD.—Cinema, King's Road; Gidea Park, Ltd.

CHORLEY.—Adapting old market as hall; Corporation Special Committee.

CROYDON.—Schools, Lodge Road (£35,060), for the Borough E.C.; director of education. Grammar school, Haling Park (£114,000); Whitgift governors. Reconstruction, premises of Woolf Bros., Ltd., North End (£5,275); E. H. Smith.

DARLINGTON.—Schools, Dodmire, Park Lane, and Borough Road, for the Borough E.C.; E. Minors, borough surveyor. Schools, for St. Cuthbert's Parochial Council; W. J. Moscrop, architect.

DARTMOUTH.—Houses (40), for the Corporation; borough surveyor (January 14th).

DONCASTER.—Proposed villas (for 500 patients); secretary, South Yorks. Board for the Mentally Defective. Silk factory, for the British Reinberg, Ltd.

DOUGLAS (ISLE OF MAN).—Entertainments hall, Strand Street, for the Strand Cinema Co.

DUNDEE.—School; clerk, Education Authority.

EASINGTON (CO. DURHAM).—Additional 100 houses, for the R.D.C.; surveyor.

EDINBURGH.—Extensions, Craigleith Hospital and Children's Home, for the Parish Council; clerk.

GUILDFORD.—Warehouse, Quarry Street; G. Brewer and Sons. Extensions, depôt, Woodbridge Road; Aldershot and District Traction Co., Ltd.

HALESOWEN.—Extensions, Grammar School; A. T. Butler.

HEMEL HEMPSTEAD.—Additional 64 houses, for the T.C.; A. Murray-Smith, borough engineer.

HERNE BAY.—Fire station, Mortimer Street; U.D.C. surveyor. Arcade and shops at Pier entrance; U.D.C. surveyor.

INDIA (BOMBAY).—Hostel extension, Medical College (Rs. 1,14,500); Municipal Commissioner. Extensions, King Edward Memorial Hospital (Rs.48,000); governors.

KILMARNOCK.—Housing scheme (30), Riccarton, for the T.C.; burgh surveyor.

LEYLAND.—New Balshaw's Grammar School; clerk to the governors.

LONDON (BETHNAL GREEN, E.).—50 tenements, Collingwood Estate; Rowley Bros., Ltd., Tottenham.

(HACKNEY, E.).—92 maisonettes, Southwold Road site; Hamer Marshall, Ltd., Westminster. Additions, Ash Grove Works, Sheep Lane; J. Hamilton & Son. Factory, Southgate Grove; A. J. King, Ltd.

(POPLAR, E.).—Rehousing scheme, West Ferry Road area (£57,000); L.C.C.

(E.C.).—Rebuilding bank, Lombard Street; Glyn Mills and Co.

(SHOREDITCH, E.C.).—Rehousing Teale Street area (£45,000); L.C.C.

LONDON (*continued.*)

(ST. PANCRAS).—Extensions, Royal Free Hospital; H. V. Ashley and Winton Newman, architects. Reconstruction, premises in Tottenham Court Road; Maple & Co., Ltd.

(CAMDEN TOWN, N.W.).—26 flats and 4 shops, Camden road; St. Pancras borough engineer.

(GREENWICH, S.E.).—School, Charlton Park Housing Estate, for the L.C.C. Education Committee.

(HAMMERSMITH, S.W.).—Town hall and municipal offices; Borough Council.

(WESTMINSTER, S.W.).—Flats, Ebury Bridge; H. V. Ashley and Winton Newman, architects.

(PADDINGTON, W.).—Remodelling old Wilberforce School; L.C.C. Education Committee.

LOWESTOFT.—Development, Broad House Estate (£11,000); borough engineer.

LOW MOOR (YORKS.).—Re-instatement, after fire (£4,000 damage), Victoria Mills; Thos. Firth & Sons, worsted spinners.

MANCHESTER.—Cinema and café, George Street and Dickinson Street, Oxford Street.

MEXBOROUGH.—Roman Catholic church; rector, Catholic Church.

MILNGAVIE.—Housing scheme (36 flatted houses) (deposit £1 1s.); F. A. B. Preston, housing architect, 6, Buchanan Street.

NORTH CRAY (KENT).—Reinstatement of Mount Muscal (mansion), after fire, for Mr. Holt.

NORTHFLEET.—Laboratory, Botany Bay; Thames Metal Co.

PAIGNTON.—Additions, Dawes Mineral Works, Curledge; B. Dawe. Smallpox hospital; Devon County Council.

PETERBOROUGH.—Baptist church; trustees, George Street Baptist Church, New Fletton.

PORTSMOUTH.—Drainage scheme, Cosham (£91,000); city engineer.

REIGATE.—Police and fire station and baths for the T.C.; Joseph Sunlight, architect, 4, St. Ann's Square, Manchester and London (returnable deposit of £2 2s.).

ROCHFORD.—Surgical wards, operating theatre, &c., for the B.G.; Norman Evans, architect, 41, High Street, Southend-on-Sea (returnable deposit of £1 1s.).

ST. BREWARD.—School for Cornwall Education Committee; B. C. Andrew, architect, New Inn Chambers, St. Austell (January 5th).

SALFORD.—Proposed enlargement of Hope Hospital (500 extra beds); clerk to Board of Guardians.

SELSDON (SURREY).—30 houses, Foxearth Road; R. Costin and Sons.

SHALFORD (GUILDFORD).—Offices, for Hambledon R.D.C.; P. G. Williams, surveyor, High Street, Bramley (returnable deposit of £2 2s.).

SHIPLEY.—Extensions, Hirst Mills; Glyn Thomas & Co., Ltd. 27 houses, Windhill; U.D.C. surveyor.

SOUTHEND-ON-SEA.—School, Wentworth (£28,970), for the Borough E.C.; director of education. Town hall and municipal offices (£358,560), for the T.C.; town clerk. Church hall (£3,000), St. Paul's Parish; O. H. Cockrill, architect.

STONE (STAFFS.).—Electric light installation, Institution, for the B.G.; clerk.

SWANSEA.—Church and school, Penygraig Road; Baptist Church trustees.

TYNEMOUTH.—Traffic offices and dwellings for Tyne Improvement Commission; Marshall & Tweedy.

WATLINGTON.—Roman Catholic church, Watcombe Road; priest-in-charge.

WELLINGBOROUGH.—Re-erection of portion of factory, for Wearaneaze Shoe Co.

WHITEHAVEN.—Housing scheme (42), for the T.C.; borough surveyor.

WORCESTER.—Smallpox hospital (£7,000); Parsons & Morrin, Birmingham.

WORCESTERSHIRE.—Mental institution; County Council Mental Acts Committee.

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# The ELECTRICAL REVIEW

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*Advertisement Index, see page xliv.* *Official Notices, see Sup. 26.*

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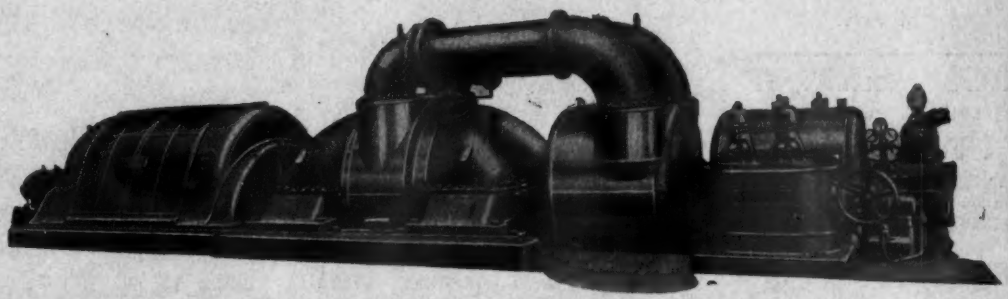

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PARTI

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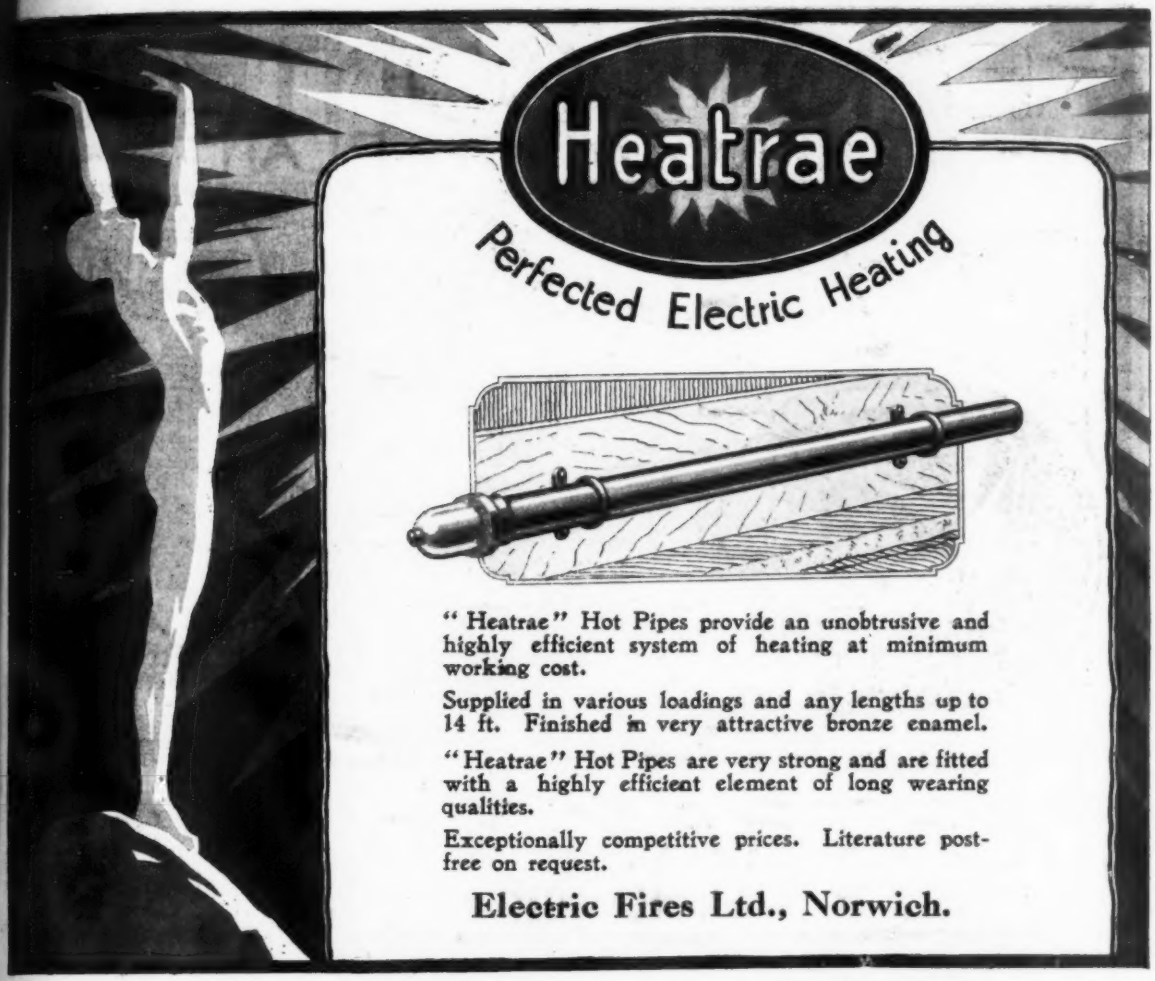


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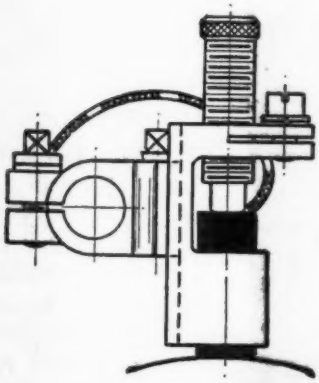

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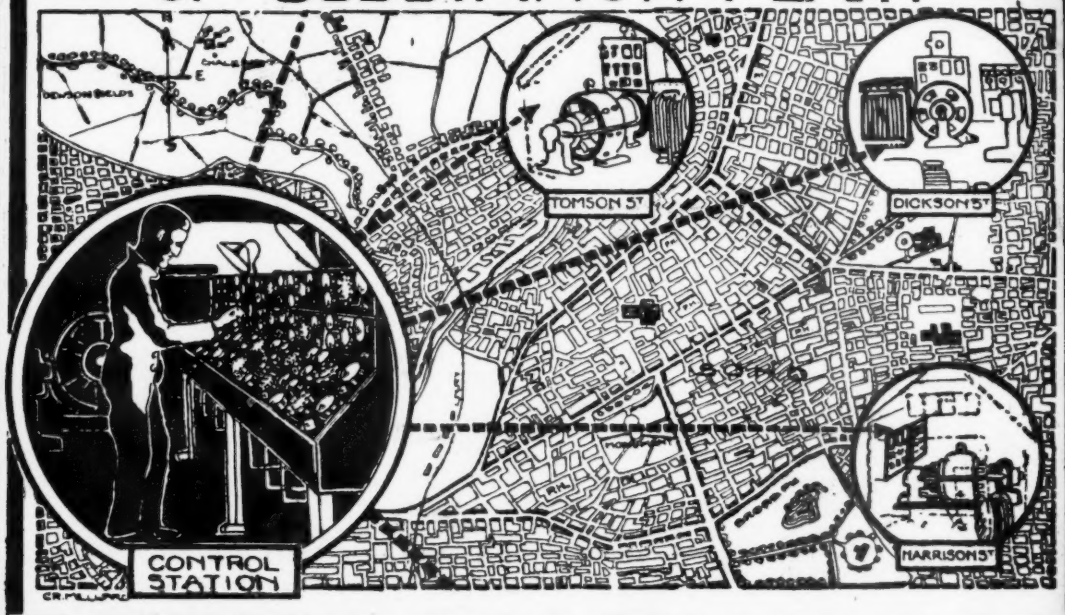


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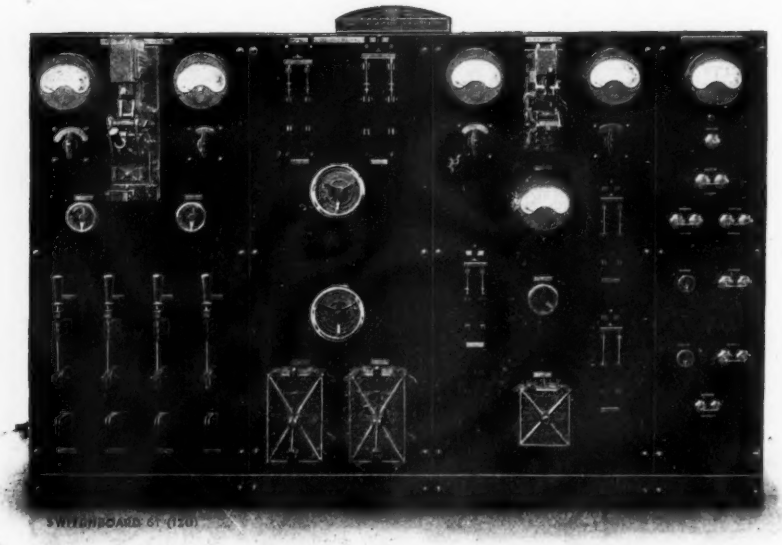

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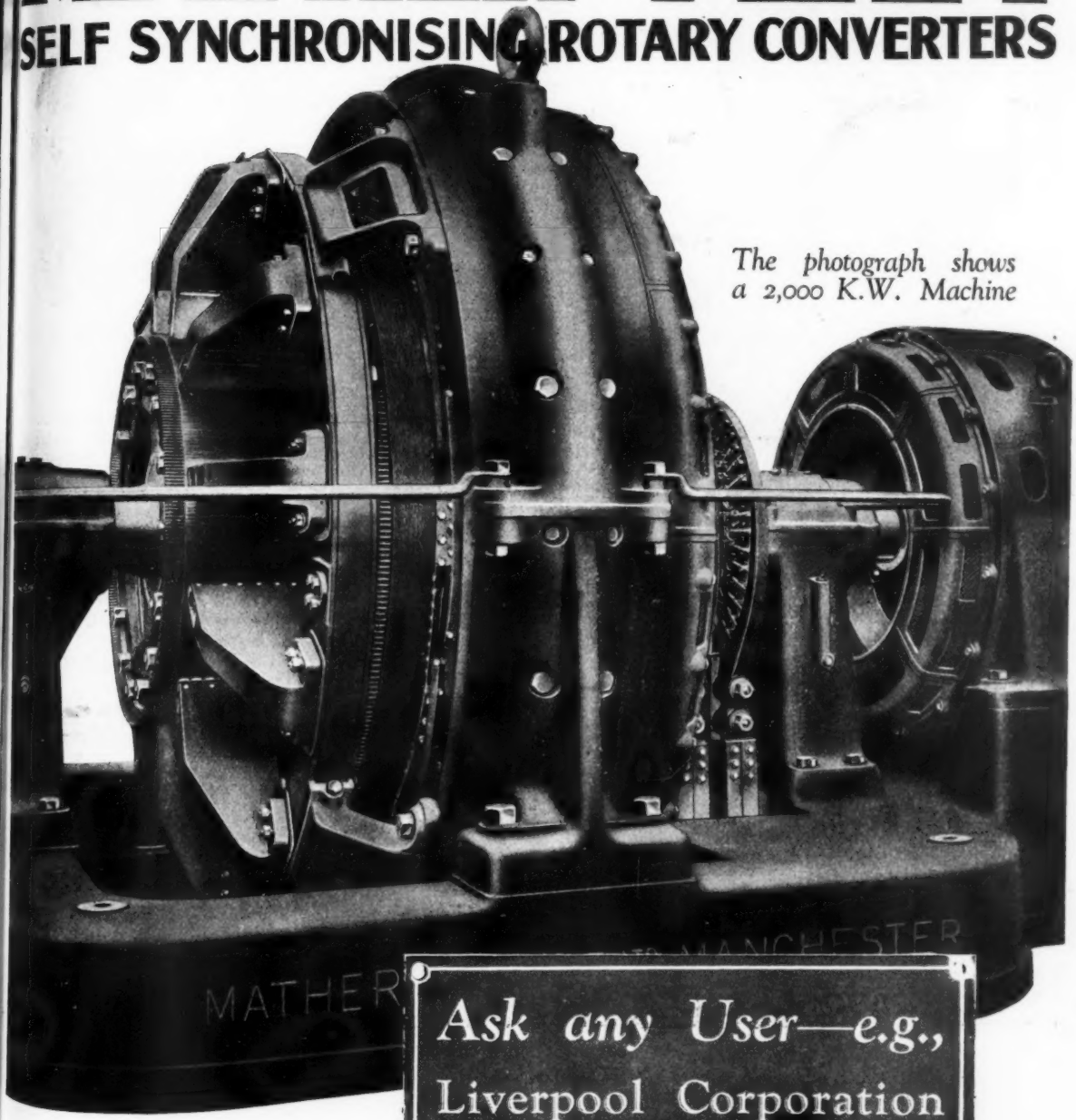


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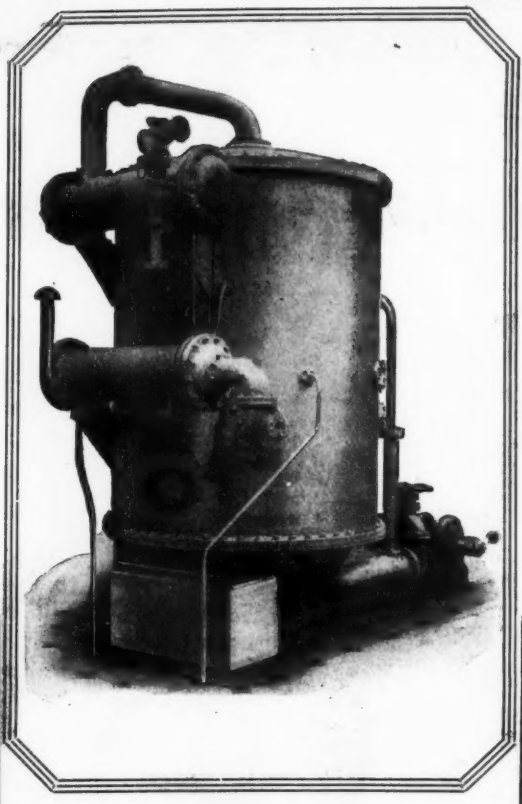

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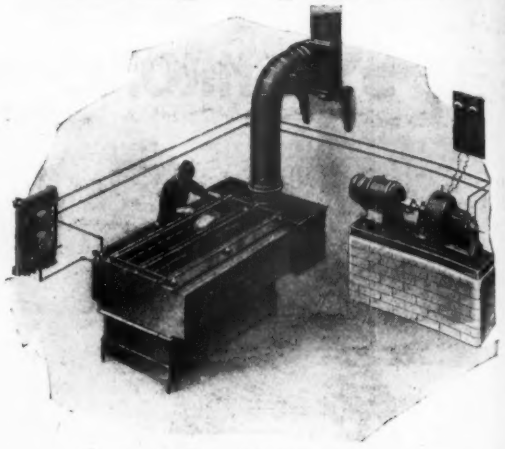

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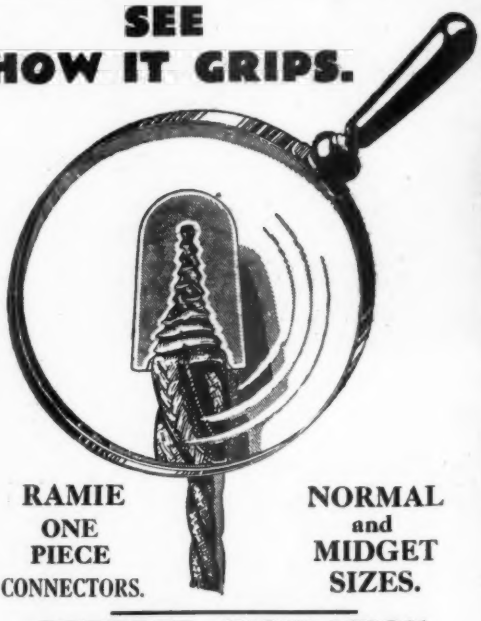

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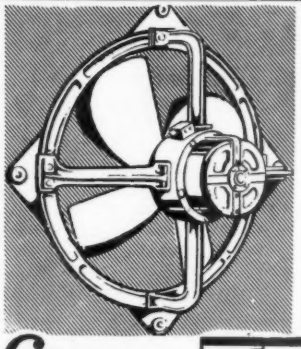

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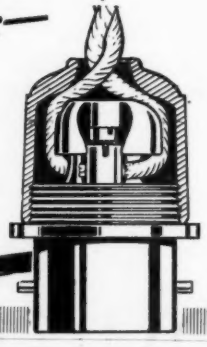

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**3352 VOLTS PER MIL**

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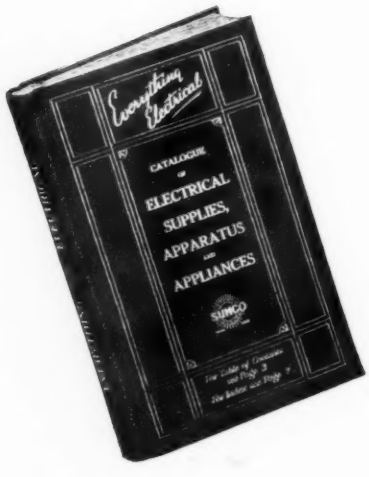


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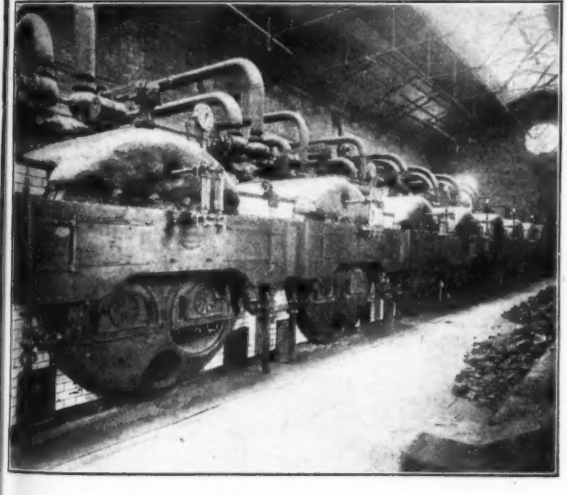

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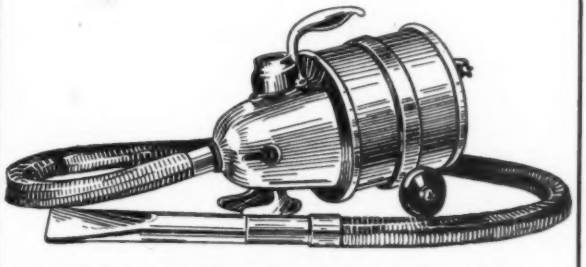

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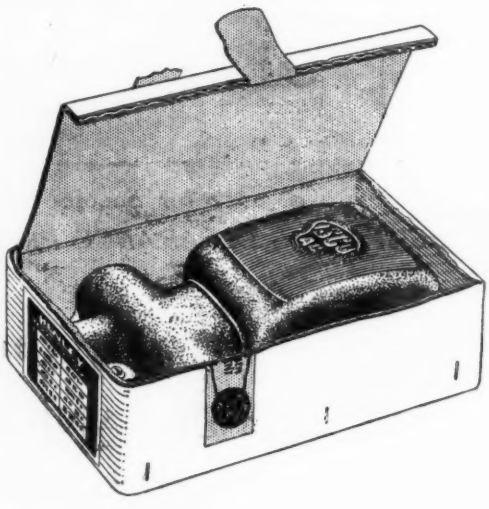

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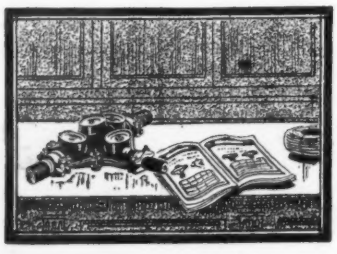

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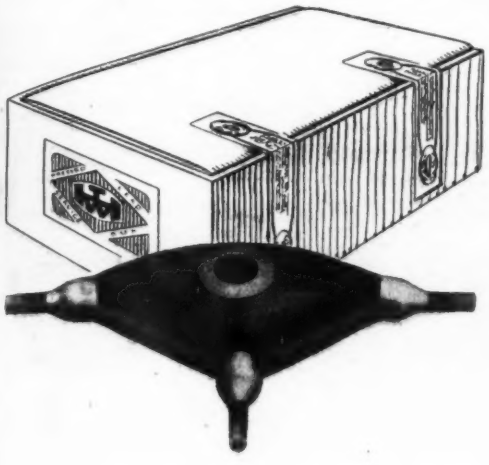


# Lead Service Boxes from stock

Henley Lead Service Boxes may be obtained from stock in all sizes. They come to you packed in corrugated cases, and can be put straight into store as received, to be re-issued, when required, in a serviceable condition. There is no risk of damage in transit or in store.

They are made of pressed lead, and are therefore uniform in shape and free from porosity.

Full particulars of the complete range, which includes cast-iron protection boxes, are given in List UCD.

*Rain cannot enter*

# Compound Buckets from stock

The Henley Compound Bucket is more than a pail. It is stoutly made of mild sheet steel, with curled and pressed seams and with the spout *welded* to the bucket. The bottom is strengthened with a mild steel ring shrunk on to the body. A one-piece pressed steel cover with *external* flange prevents the ingress of rain. All parts are heavily galvanized. In short, it is a bucket that will give years of service.

List UM1 gives full particulars of this bucket; also of compound and jointing accessories.

***Buy over the counter at these HENLEY Branches.***

EDINBURGH - - 15, South St. David Street.
ABERDEEN - - - - 3, Union Row.
GLASGOW - - - 59/61, Waterloo Street.
CARDIFF - - - - 5, Burt Street, Docks.
BELFAST - - - - 26, Fountain Street.
DUBLIN - - - - - 43, Dame Street.
NEWCASTLE-ON-TYNE Pandon Bldgs, Manors.

LIVERPOOL - - - 37/41, Duke Street.
MANCHESTER - 4, Marble St., Spring Gardens,
LEEDS - - - - - 95, Albion Street.
SHEFFIELD - - - - 24, York Street.
BIRMINGHAM - - - Broad Street Chambers.
NORWICH - - - 19, Prince of Wales' Road.
BRISTOL - - - - - 11, Nelson Street.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., HOLBORN VIADUCT, LONDON, EC1

BY APPOINTMENT

*Peak Loads*

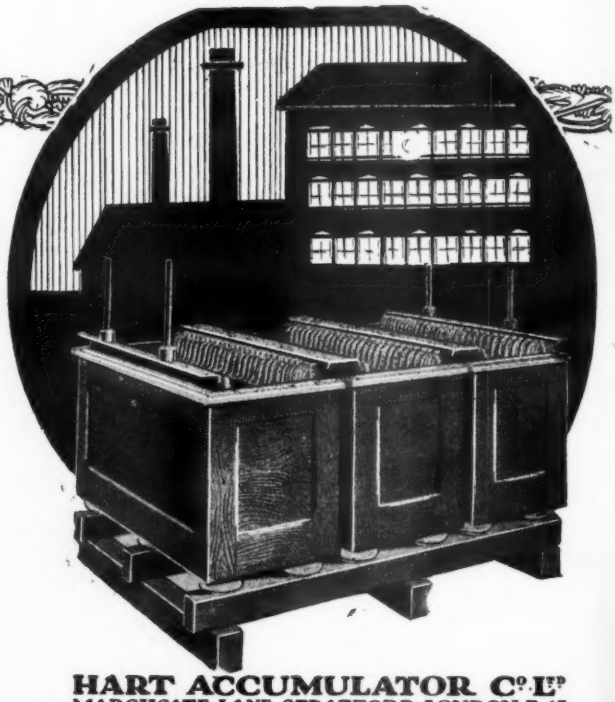
*present no difficulties to users of*

**HART**

**THE BATTERY OF QUALITY**

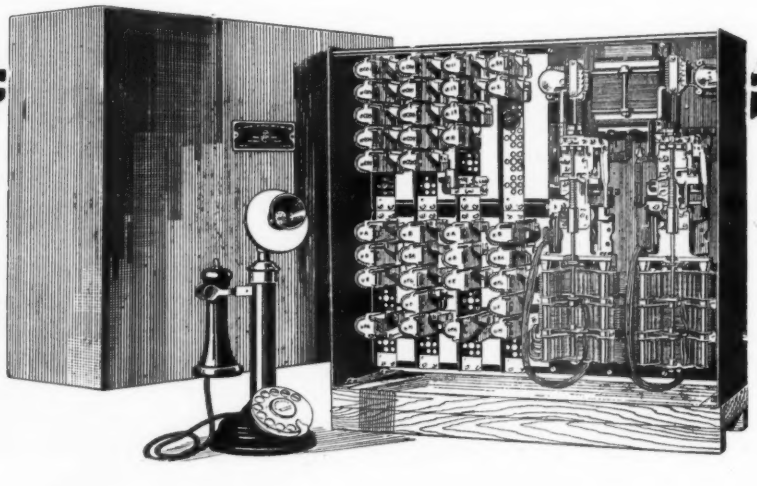
which ensures that first essential of electric lighting installations

**RELIABILITY OF SUPPLY**



**HART ACCUMULATOR Co. Ltd.**
MARSHGATE LANE, STRATFORD, LONDON, E. 15
*Telephones:*—Maryland 1361, 1362, 1363 *and* 1364
Branch Offices *and* Showrooms—BELFAST, BIRMINGHAM, BRISTOL, CARDIFF, DUBLIN, GLASGOW, MANCHESTER, WESTMINSTER & YORK.

**March with the Times "Step by Step."**



*Upwards of 4,000,000 Strowger Automatic Telephones on order or under construction throughout the world.*

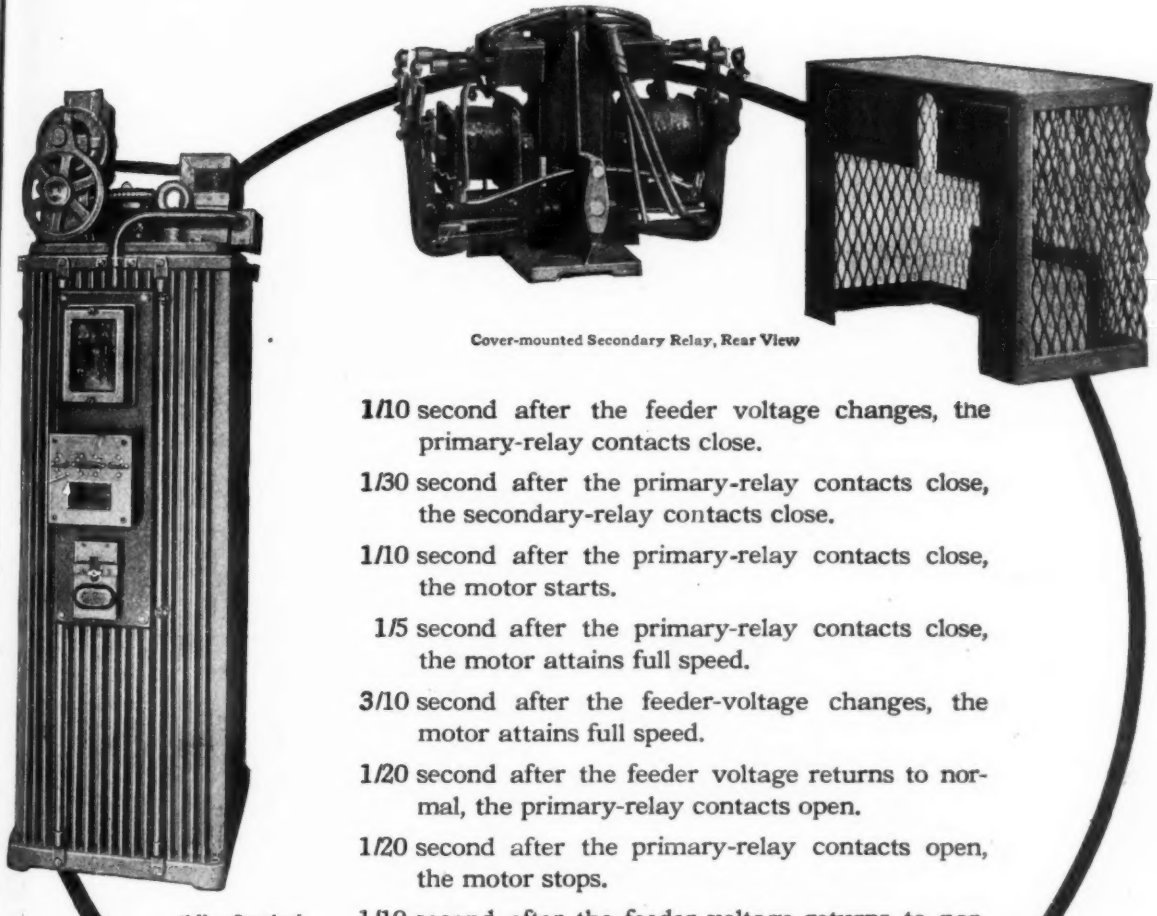
In public telephone service, Strowger Robots, the mechanical equivalents of the old time telephone operators, are already serving the world to the tune of over 4,000,000 stations. In a private capacity they can serve you and give telephone facilities unequalled for speed, accuracy, privacy, and above all reliability.
Send for particulars of any capacity of Strowger Private Automatic Exchange. The type illustrated serves up to 10 lines.

*AUTOMATIC TELEPHONE MANUFACTURING CO., Ltd., Strowger Works, LIVERPOOL*

**STROWGER** ATM

# Close Voltage Regulation

The close voltage regulation of **Westinghouse Induction Voltage Regulators** is due to the high-speed operation of the primary relay, and of the cover-mounted secondary relay and motor.



Cover-mounted Secondary Relay, Rear View

46-Kv-a Standard Regulator, Complete with Panel and Automatic Accessories

1/10 second after the feeder voltage changes, the primary-relay contacts close.

1/30 second after the primary-relay contacts close, the secondary-relay contacts close.

1/10 second after the primary-relay contacts close, the motor starts.

1/5 second after the primary-relay contacts close, the motor attains full speed.

3/10 second after the feeder-voltage changes, the motor attains full speed.

1/20 second after the feeder voltage returns to normal, the primary-relay contacts open.

1/20 second after the primary-relay contacts open, the motor stops.

1/10 second after the feeder voltage returns to normal, the motor stops.

**WESTINGHOUSE ELECTRIC INTERNATIONAL Co.,**

150, Broadway, New York, U.S.A.

2, Norfolk St., Strand, London, W.C., ENGLAND.

*Cables: "WEMCOEXPO," New York or London.*

W WESTINGHOUSE ELECTRIC

# Westinghouse

X 70620

# *A Contract*

for a complete Two-solution Foam System for the protection of the

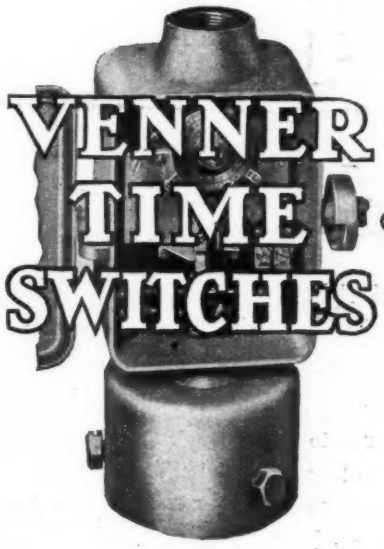
## AUSTRALIAN COMMONWEALTH GOVERNMENT

## TANK FARM at PORT DARWIN

has been obtained by

FOAMITE FIREFOAM LIMITED,

55/57, Great Marlborough Street, LONDON, W. 1.




Were approved by the Board of Trade back in 1908.

The *only* BRITISH TIME SWITCHES to be passed by the UNITED STATES BOARD OF FIRE UNDERWRITERS.

Control the Electric Street Lighting, not only in the chief cities and towns in the British Isles, but in every Continent.

have been on the market for 22 years and have been the leaders all the time. They are yet!

are made for every purpose, for currents from 0·1 to 1,000 amperes, and voltages up to 6,600.

THE NAME OF "VENNER" IS SO ASSOCIATED WITH TIME SWITCH PRACTICE THAT IT HAS BEEN ACCEPTED BY THE PATENT OFFICE AS A REGISTERED TRADE MARK.

---

# SAFETY FIRST-and ALWAYS-ORDER VENNERS.

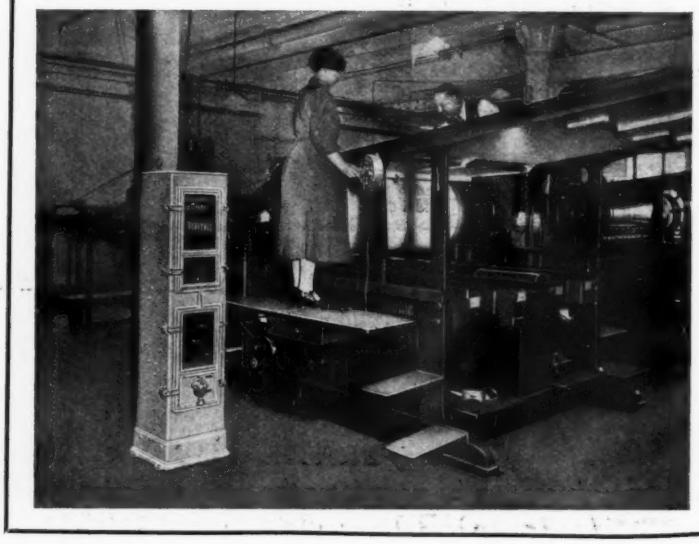
*CATALOGUES ON REQUEST.*

VTS **VENNER** TIME SWITCHES LIMITED

45, HORSEFERRY ROAD, WESTMINSTER, LONDON, S.W.1. *Tel. Ad.* CLOXWICHES, PHONE, LONDON.

*The Switch that does everything—except fail*

B



# *Under her hand!*

THE control of this electrically driven printing press is right under the operator's hand. The control box comprises a push button for starting, another for "inching" and a central "stop" lever, which can be quickly operated in an emergency.

Speed control can be ignored for the speed is set before each run to suit the forme and paper, and thereafter the motor accelerates to that speed each time it is started. Protective devices prevent damage to the motor or to the operator, since "live" parts cannot be touched.

For other types of press, a small push button station (working in conjunction with an automatic regulator) allows complete control of the speed from the working position.

Booklet No. 245 C will show you where Brookhirst experience on Printing Press drives can enable you to effect economies and improve results. Write for a copy.

*Photograph shows a three-colour Miehle press at the works of W. S. Cowell, Ltd., Ipswich, controlled by a Brookhirst Automatic Starting Panel, comprising :—*

*Solenoid Type Starter obviating burning and sticking. Regulator for speed setting and Accelerator for running motor up to set speed. No-volt and overload release Circuit Breaker, preventing damage to the motor. Isolating Switch preventing contact with "live" parts.*

## BROOKHIRST SWITCHGEAR LIMITED CHESTER

*Australia House, London, W.C.2. Blackfriars House, Manchester. Essex House, Temple St., B'ham. Bank of L'pool Chbrs, Park Row, Leeds.*

BAILEY'S

## 'B.B.' Type GYROMETER

SHOWS SPEED AT A GLANCE IN REVS. PER MIN.

WE make all kinds of Indicators and Recorders for Pressures, Speeds, Level & Flow of Water, &c.

Air Compressors, Steam Pumps, Valves, &c.

ESTABLISHED 1839.

SIR W. H. BAILEY & CO., LTD., Manchester.

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## Battery Plates & Peroxide

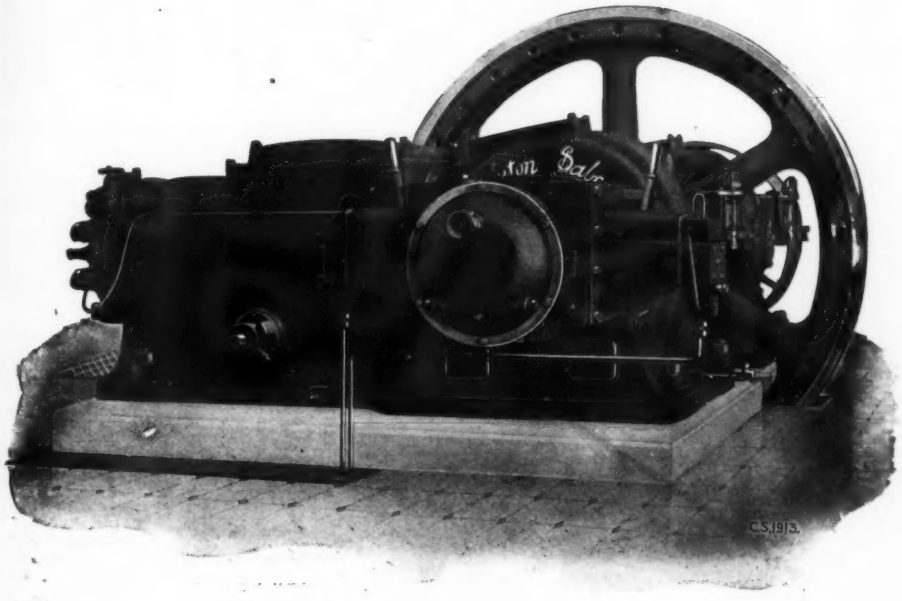
PROMPT SETTLEMENT

## Capper Pass & Son Ltd

SMELTERS & REFINERS

BEDMINSTER SMELTING WORKS • BRISTOL

TELEPHONE 8080 (3 LINES) TELEGRAMS "PASS BRISTOL"



# ARE YOU ECONOMISING ?

Economy figures very prominently in industry to-day, and to the power user it applies with extra force. Cheap power is the universal demand and in designing the Clayton-Babcock Cold Starting Oil Engine this fact has been specially borne in mind.

It has been the object of the designers to produce an engine which is robust, extremely simple and economical in operation. A glance at the illustration will prove the former, while the latter is borne out by the large number of satisfied users.

The symmetrical design of the cylinder head eliminates the possibility of fractures, and as all complicated valves and valve gear have been dispensed with the maintenance charges are almost negligible.

The gaining of the Silver Medal—highest award—at the Royal Dublin Society's Show is conclusive proof of the high merits of the Clayton-Babcock engine.

***May we mail our Catalogue E376 to you ?***

**CLAYTON & SHUTTLEWORTH, LTD.,**
***ENGINEERS*** - - - **LINCOLN**

# CLAYTON-BABCOCK COLD STARTING HEAVY OIL ENGINE

SIZES 30 B.H.P. TO 150 B.H.P.

# THE PIONEER

FIFTY YEARS AGO TURNER BROTHERS ASBESTOS COMPANY CONSISTED OF FIVE MEN: TO-DAY THE TURNER AND NEWALL GROUP COMPRISES EIGHT WORKS—COVERING ONE HUNDRED & FIFTY ACRES—SEVEN ASBESTOS MINES, INCLUDING THE LARGEST PRODUCING UNIT IN THE UNION OF SOUTH AFRICA, & OVER 5,000 EMPLOYEES.
Norman Wilson

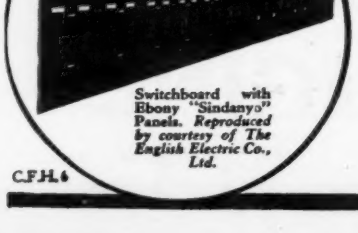
*"There's no sense in going further—it's the edge of cultivation."*
*Kipling.*

IN an Industry, if it is to survive, there must always be those that give brains and capital freely in the attempt to win better and still better value for the users of their products and whose trail of progress is blazed by rejected ideas and scrapped equipment.

EBONY "SINDANYO" represents seven continuous years of scientific investigation in the laboratory, the workshop and in service; it is no accident, as are the materials it is rapidly superseding, but is to-day *exactly what we intended it to be* when first we set out to produce it, ten years ago.

There is no valid reason why any manufacturer of Switch and Control Gear should continue to mount apparatus on the *unscientific* materials that were only just good enough at the birth of the Electrical Industry and which, under to-day's conditions, are fundamentally unsound, when the use of Ebony "Sindanyo" *not only raises the standard of quality of the complete product*, but actually materially reduces the total cost of production of the unit.

One of our Engineers is at your service at all times to discuss this unique material with you.



Switchboard with Ebony "Sindanyo" Panels. *Reproduced by courtesy of The English Electric Co., Ltd.*

C.F.H.6

"SindanyO" REGISTERED

INSULATING BOARD

·DIELECTRIC·HOMOGENEOUS·STRONG·

TURNER BROTHERS ASBESTOS COMPANY LTD., ROCHDALE, ENGLAND

Manufacturers of
EVERYTHING IN ASBESTOS
for the
Electrical, Electro-Chemical and Mechanical Engineering Industries

# Empire Controllers

## A.C. CONTACTORS

*D.P. Low Tension A.C. Contactor.*

Twenty years' specialised experience is embodied in the design of "Empire" Contactors. A complete range is standardised from 25 to 500 amperes for all standard voltages and periodicities. They are simple and robust in design, and suitable for the most severe conditions of service.

**ELECTRIC CONTROL LIMITED,**
**EMPIRE WORKS, BRIDGETON, GLASGOW.**

EMPIRE ELECTRIC CONTROL

# 70 YEARS OF SAFE SERVICE

WE ARE PIONEERS in the design and manufacture of lifts of all kinds. These British lifts backed by 70 years' experience have earned a world reputation for economy in working and great reliability. They embody every modern refinement.

*We undertake complete installations. Write for our "Classifile" folder No. 101, and you will there find our catalogues.*

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PICKERINGS LIMITED,
Globe Elevator Works - Stockton-on-Tees.

Telegrams: "Pickerings, Stockton-on-Tees."
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*Also at*

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BRISTOL. E. P. Loose, 11, Archfield Rd., Cotham.

BIRMINGHAM. 41, Clarence Road, Moseley. *Tel.: B'ham. South 1034*

MANCHESTER. F. O. Burnley, 3, Orchard Road, Altrincham, Cheshire. *Tel.: Altrincham 1919*

BELFAST. F. A. Porter & Co., 13, Queen's Square *Tel.: Belfast 392*

Established 1814. Telegrams: "**QUALITY**" Worcester. Telephone: 160 Worcester.

# "SAFETY prevents ANXIETY"

**AND OUR** PATENT No. 225088/24

# "SAFETY-FIRST" LAMP PILLARS

ARE THEREFORE

## FAST BECOMING

THE

## LAMP PILLARS

OF THE

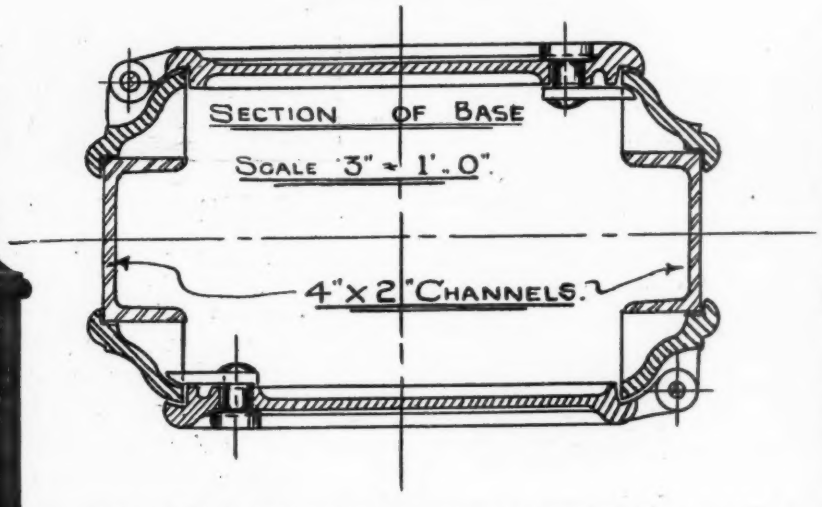
## FUTURE.

CAN BE CARRIED OUT IN ANY DESIGN TO SUIT CUSTOMERS.

NEW DESIGN No. 1444.

FRONT VIEW.

**DESCRIPTION:**




This patented construction of Lamp Pillar is applicable to all sizes of Pillars and provides a WROUGHT CONSTRUCTION throughout from bottom of underground part to top of Pillar WITHOUT ENCROACHING on the space for Switches, etc., in the Base, as is THE CASE when a Wrought Pole Shaft is carried right through the Base; thus enabling a MUCH SMALLER BASE to be used and such as will not UNDULY ENCROACH on the Pavement Space.

**N.B.**

This No. 1444 design of "Safety-First" Pillar gives the wrought skeleton throughout consisting of two 4″×2″ mild steel Channels, rivetted on to a mild steel tubular shaft of 4″ bore × ¼″ thick.

It will be noticed that looking end-on at Base Body it only measures some 9″ wide outside and yet gives a clear internal space to take apparatus of 22¼″ high × 10½″ wide × 7¾″ deep.

N.B. The Base can have either two Doors or one Door and fixed back panel.

END VIEW.

*Prices and Particulars on application to the SOLE MAKERS:*

# HARDY & PADMORE LTD.,

## WORCESTER - - - ENGLAND.

*Makers of Wrought and Cast Feeder and Transformer Casings.*

# NEW YEAR'S NOTE

# SIEMENS
# V.I.R. CABLES

**SIEMENS BROTHERS & CO., LTD.,**
WOOLWICH, LONDON, S.E.18.

*And at Belfast, Birmingham, Bristol, Cardiff, Dublin, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, Southampton.*

# HENLEY'S OVERSEAS

*On this page every fortnight will be featured some aspect of our overseas activities. We commend the pages to your interest and attention.*

## Records

Here are two modern factories which make records every day—thousands of them. They are both in Sydney, N.S.W., and both are wired throughout with Henley Cables.

The Gramophone Company—famous all over the world as manufacturers of "His Master's Voice" gramophones and records and Columbia Graphophone Limited, equally famous for "the record without scratch"—both demand the highest quality materials.

They are wired with Henley Cables—as famous, in their own field, as His Master's Voice and Columbia gramophones and records are in theirs. Famous because of their reliability; their high quality; and their long life.

**HENLEY CABLES**

**HENLEY SERVICE** *Overseas—Service that is sure to please.*

407

**W. T. HENLEY'S TELEGRAPH WORKS COMPANY, LIMITED, Holborn Viaduct, LONDON, E.C.1.**

**OVERSEAS BRANCHES:**

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**AUSTRALIA.**—**Melbourne:** 205-7, William Street. **Sydney:** 83, Clarence Street. **Brisbane:** 59, Elizabeth Street.
*Agencies at*:—**Adelaide, Perth, Newcastle, Hobart (Tasmania).**
**INDIA.**—**Calcutta:** Henley House, Old Court House Corner. **Bombay:** Henley House, Ballard Estate.
*Agencies at*:—**Madras, Rangoon, Karachi, Delhi, Colombo, Lahore.**
**SOUTH AFRICA.**—**Johannesburg:** 17-20, Standard Bank Chambers (P.O. Box 5015). *Agencies at*:—**Capetown, Durban, Port Elizabeth, Lourenco Marques, Bulawayo.**

**OVERSEAS AGENCIES:**

**BRAZIL.**—**Rio de Janeiro:** Henry Rogers, Sons & Co. (of Brazil), Ltd., 3. Rua Visconde de Inhaums, 85, Caixa Postal, 1047.
**Sao Paulo:** Henry Rogers, Sons & Co. (of Brazil), Ltd., Rua Jose Bonifacio, 47.
**CHINA.**—**Shanghai:** The Jardine Engineering Corporation, Ltd., 8A, Yuen Ming Yuen Road. *And at*:—**Hong-Kong, Tientsin, Harbin, Mukden, Tsingtao, Peking, Hankow and Amoy.**
**EGYPT & SOUDAN.**—**Cairo:** Sayer & Colley, "B" Khedivial Buildings, Sharia Emad El Dine. **FRANCE.**—**Paris:** Ad. Seghers, 4, Rue de la Michodière.
**MEXICO.**—**Mexico D.F.:** Watson Phillips & Co., Avenida Uruguay Num. 103. Apartado Num. 67.
**NEW ZEALAND.**—**Wellington:** Turnbull & Jones, 19-23, Blair Street, *And at*: **Auckland, Ashburton, Christchurch, Dunedin, Hamilton, Invercargill, Oamaru.**
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**WEST AFRICA.**—The Niger Co., Ltd., and Associated Companies: **Belgian Congo, French Congo, Dahomey, Cameroons, French Guinea, Portuguese Guinea, Gold Coast, Gambia, Ivory Coast, Seychelle Isles, Nigeria, Senegal, Sierra Leone, Liberia.**

# On the Menai Straits

some distance above the famous Suspension Bridge, nestles the little holiday-town of Llanfairfechan. The illustration shows the sea-front, with Anglesey in the distance, and an Angle and Sectional Pole on the Henley Overhead Line which Henley Engineers are erecting for the North Wales Power Company.

The Suspension Bridge over the Menai Straits is an example of engineering skill. So is the Henley Power Line. Carrying Heat, Light, and Power to outlying Mines and Factories, and remote villages, the Henley Power Line bridges the gap between power station and consumer by the best possible method known to engineers.

We are proud of the part which we have taken in this march of progress. And proud of the fact that Henley Lines are trouble-free lines and reliable lines. Our experience is at your service.

*We manufacture AERIAL CABLES of all types. Let us have the opportunity of quoting for your next requirements.*

**HENLEY**

**OVERHEAD LINES**

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., HOLBORN VIADUCT, LONDON, E.C.1

*Branches at Aberdeen: 8, Union Row. Belfast: 26, Fountain Street. Birmingham: Broad Street Chambers. Bristol: 11, Nelson Street. Cardiff: 5, Bute Street Docks. Dublin 43, Dame Street. Edinburgh: 15-17, South St. David Street. Glasgow: 59-61, Waterloo Street. Leeds: 95, Albion Street. Liverpool: 37-41, Duke St Manchester: 4, Marble Street, Spring Gardens. Middlesbrough: Norton Street. Newcastle-on-Tyne: Pandon Buildings, Manors. Norwich: 19, Prince of Wales Road. Sheffield: 24, York Street*

# NOTE!

THE DISTINCTIVE FEATURES OF THE

# "KING SOL"

## BOWL FIRE

The strong ELEMENT GUARD of novel design which permits easy cleaning of the reflector, and so assures efficiency being maintained.

It also serves as a stand for kettles or other small utensils when the reflector is tilted to a horizontal position.

D.S. 451.

The particular form of REFLECTOR which gives a wider distribution of heat than usual.

The substantial cast-iron BASE which prevents any possibility of toppling over.

STOCK FINISH—BRONZE.

*Packed in strong Cartons.*

List No. D.S. 450, 10" BOWL, **21/-**
" " D.S. 451, 12" " **22/6**
*Complete as illustrated.*

*Deliveries from Stock.*

BERRY'S ELECTRIC, (1928) LTD.

LONDON: 85 and 86, Newman Street, W.1.
BIRMINGHAM: Ironclad Works, Hall Green.
MANCHESTER: 5, Deansgate.

# Pocket Size A·C TESTING INSTRUMENTS

*Model 528.*

The design and construction of this model are exceptional, and fully maintain the high standard of Weston craftsmanship. It is a small and reliable instrument for General A.C. and Radio Service, but should not be classed with the usual instrument that is offered for the latter purpose. The sensitivity is remarkably high: 6ma. for 600 volts with self-contained resistance. The scale is very legible and the damping excellent. It is capable of continuous service at full load and is available for all commercial frequencies.

| | |
|---|---|
| 150 and 15 volts | £3 10 0 |
| 300 and 150 volts | £4 0 0 |
| 600 and 300 volts | £4 15 0 |
| 150, 8 and 4 volts Triple range | £4 5 0 |
| 1, 3 or 5 amps | £3 10 0 |
| 10 or 20 amps | £3 10 0 |
| 30 amps | £4 0 0 |
| 15, 25, 50, 250 or 500 milliamperes | £3 10 0 |

# WESTON

## STANDARD THE WORLD OVER

*Pioneers since 1888.*

WESTON ELECTRICAL INSTRUMENT CO., LTD.
15, Gt. Saffron Hill, London, E.C.1.

# HACKBRIDGE
## THERMAL RELAY

THE large number of enquiries we have received for these instruments would indicate that their application is not limited to Transformer Service.

They can be used wherever a critical temperature (between 50 and 120 degrees C.) is required to operate an auxiliary or external circuit, and our Research Department is prepared to advise and to carry out tests in any particular case.

Engineers are cordially invited to submit problems involving such conditions, and may accept our assurance of co-operation.

**HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD.,**
**WALTON-ON-THAMES, SURREY.**

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## CABLES WHICH WILL NOT KINK OR BRUISE

Take care the cables you specify for that surface installation are not liable to mechanical damage, and so become unsightly and unsatisfactory in use.

The tough rubber sheathing of St. Helens C.T.S. will not kink or bruise. If accidentally hit with a hammer during erection the hammer will rebound, the cable itself not being in any way affected.

One man can do a C.T.S. wiring job. The cables can be handled with carefree confidence, unwinding easily and quickly from the reels, whereas other systems require continued attention to prevent kinking and damage, a trouble unknown with St. Helens C.T.S.

Use this wiring system which will cut down your labour costs, make a quick, sound, clean and satisfactory job.

**The only tools necessary on a C.T.S. Job.**

*"It's the little things that matter"*

*"The Original System"*

# ST. HELENS C.T.S.

('Phone 333.) **ST. HELENS CABLE & RUBBER COMPANY, LIMITED, SLOUGH.** ('Grams: St. Helens.)

# WIRELESS

Our New Catalogue is ready embodying the latest models of

*Radio Sets (Cabinet and Portable), Loud Speakers, H.T. and L.T. Batteries, Trickle Chargers, etc., etc.*

**If you have not received a copy write and ask to be included in our Mailing List.**

## Drake & Gorham Wholesale, Ltd.,

**67, LONG ACRE, LONDON, W.C.2**

Branches :—MANCHESTER : 29, Piccadilly ; BELFAST : 63, Victoria Street ; LIVERPOOL : 9, Granite Buildings, 6, Stanley Street ; BRIGHTON : 24, Marlborough Place ; GLASGOW : 58, West Campbell Street ; BRISTOL : 35, Broad Street ; DUBLIN : 2, Church Lane, College Green. Midland Representative : W. T. BOWER, 184, Jockey Road, Sutton Coldfield.

A full supply of HOT WATER instantly available with

**Designed in all capacities from 4½ to 450 galls. over 20,000 *'Cumulus'* Heaters have been installed.**

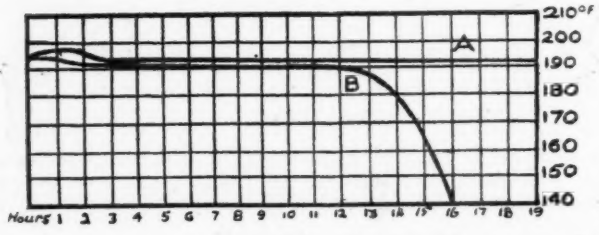
# CUMULUS

THERMAL STORAGE TYPE

**ELECTRIC WATERHEATERS**

FOR ALL PURPOSES

***Here is convincing proof of the efficiency of the "Cumulus Water Heater."***




**CURVE "A"** shows the water heated to 196° F., current switched off, and no water withdrawn during the test. The water temperature rises to 197.2° F., at the end of the first hour, owing to heat stored in the heater passing to the water; 19 hours after switching off the temperature is still 192° F. —a fall in temperature of only 4° F. in 19 hours. This proves the remarkable efficiency of the heat insulation.

**CURVE "B"** is a curve approximating to working conditions. Current off throughout the test and an initial water temperature of 196° F. One-sixteenth of the full capacity (13¾ gallons) is withdrawn every hour for 16 hours and an equal quantity of cold water at 52° F. admitted. At the end of the 13th hour the temperature of the water delivered is 187° F., or 9° F., below the initial water temperature; even at the end of the 16th hour, after current has been shut off, the temperature of the last drop of water originally heated is 142° F.

May we send you further details?

**NATHAN & ALLEN, 25, Victoria Street, LONDON, S.W.1**

Hotpoint

# TOAST-OVER TOASTERS.

Hundreds of homes need this appliance.

To toast both sides of the slice without handling and to be absolutely sure of results—a Hotpoint Toast-Over Toaster is needed above all else.

*May we send you over-printed literature to mail to your customers?*

**The Hotpoint Electric Appliance Co., Ltd.**

**Head Office: 24 Newman St., London, W.1.**
Museum 8327 & 8328. "Hotpoint," Wesdo, London.

*Also*

**Hotpoint House, 99, Corporation Street, MANCHESTER.**
(City 3007/8)
**164, Howard Street, GLASGOW** (Central 798)
**18, Chester Street, BRADFORD** (Phone 5548)
**Viscosa House, George Street, NOTTINGHAM**
(Phone 2620)

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FOR THE
# ELECTRICAL INDUSTRY.

***Enquiries for:***

FUSE, SWITCH, METER BOX and JUNCTION BOX CASTINGS in ALL SIZES to YOUR DESIGNS.

FLANGED MOUNTINGS for OIL SWITCHES, TRANSFORMERS and INSULATORS.

LIGHT FRAME STANDS or HEAVY COLUMNS.

**WEIGHT 1 lb. to 1 ton.**
**Either Special or Repetition Work.**

**THOMAS ALLAN & SONS, LTD.,**
**BONLEA FOUNDRY,**
**THORNABY-ON-TEES.**

**'PHONE:** STOCKTON } 821 822 **'GRAMS:** "BONLEA, Stockton-on-Tees."

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**Make Plants from 0.5 to 50 kW, also Automatic Switchgear Equipment to enable the fully Automatic Operation and Control of all types of Lighting Plants, including**

**CRUDE OIL PLANTS,**
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**for either**
**Direct Running or with Accumulators.**
**Range from Half to Fifty Kilowatts.**

**Standardised Components**
FOR
**Automatic Lighting Plants.**

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**Austinlite, Ltd.,**
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## SWITCH OVER TO THE NEW PRINCIPLE OF ELECTRIC SOLDERING IRONS

## ZEVA

*NOTE THESE REMARKABLE FACTS:—*

***You are safe with the ZEVA guarantee Six months' life—or a new one free.***

**The ZEVA Guarantee, of 6 months' wear, 8 hours a day, or replacement without charge, does not signify that ZEVAS only last 6 months—indeed we know of ZEVAS which have been in constant use for several years.**

**Remember the average soldering irons rarely last more than three months, and a single renewal of the heating element costs half the original price of the tool.**

**So that ZEVAS definitely save you money. ZEVAS, too, are speedier, lighter, stronger, and are perfectly balanced.**

**There is also the popular range of ZEVA Electric Crucibles, used universally by leading manufacturers.**

**Write now for free Illustrated Booklet.**

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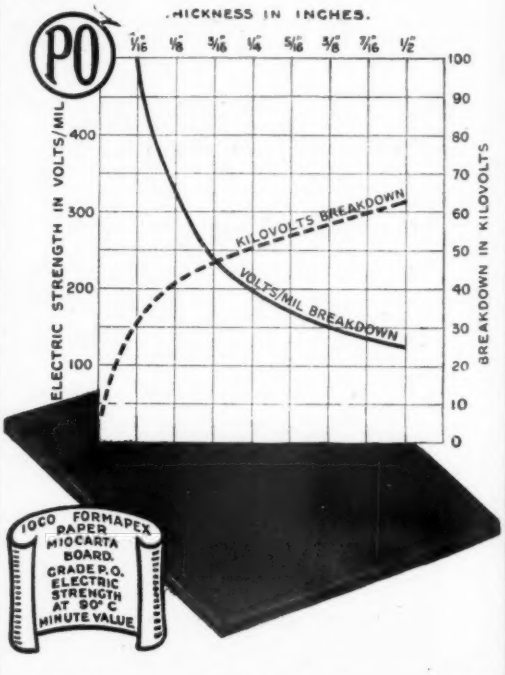
*Telephone: Victoria 4350.*

# TESTED INSULATION

## *for* HIGH VOLTAGES

### 'Formapex' Miocarta Board

'Formapex' Miocarta Board consists of paper sheets treated with 'Formapex' gum in a specially dehydrated state, pressed together in heated hydraulic presses. Grade P.O. is a general purpose grade for high voltages possessing an electric strength of a very high order as will be seen from the curve reproduced below:—




**Grade P.O. is made either black or tan and is specially suitable where it is necessary to use a board with a very high electric strength and intricate machining properties.**

*For full details of this and other grades of 'Formapex' Miocarta Boards and Tubes, send for List No. 11.*

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**Ioco Rubber & Waterproofing Co. Ltd.**

**Anniesland . . . Glasgow**

Z A11

# Standard
# 33,000 VOLT CABLE

TESTS carried out on the Cable illustrated below proved that this 33,000 volt H-type Cable possessed the advantages enumerated hereunder:—

1. HIGH FACTOR OF SAFETY.
2. LOW DIELECTRIC LOSSES AT WORKING TEMPERATURE.
3. NO IONISATION UP TO DOUBLE WORKING VOLTAGE.
4. NO IONISATION AFTER HEATING.
5. HIGH CURRENT CARRYING CAPACITY.

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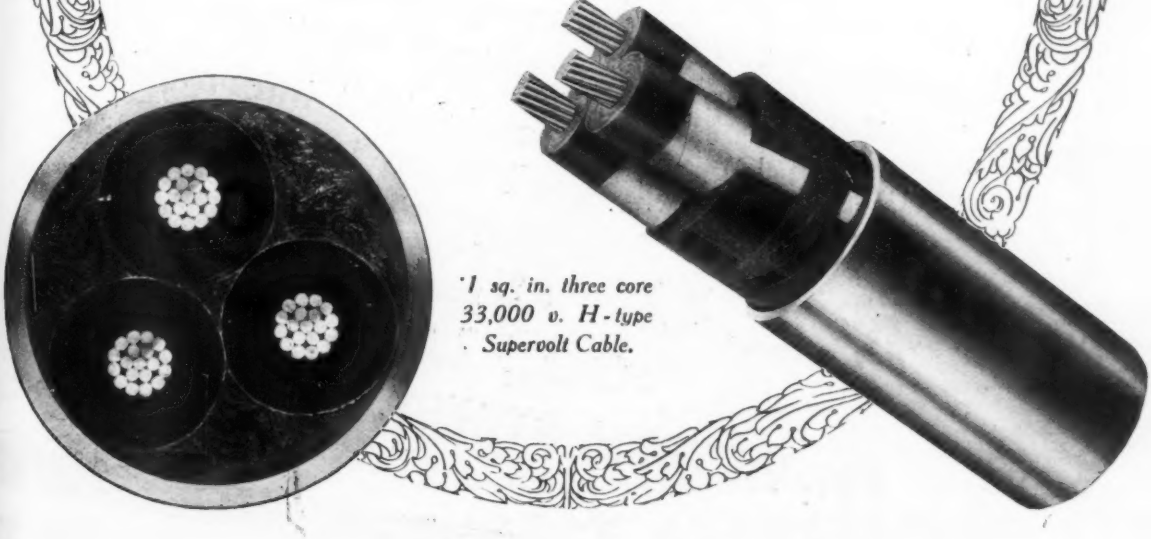
'Phone: Holborn 8765 (15 lines).

*Works: Hendon, North Woolwich, New Southgate.*

*Branches:* **GLASGOW, LEEDS, BIRMINGHAM, MANCHESTER, LIVERPOOL and DUBLIN.**



*1 sq. in. three core 33,000 v. H-type Supervolt Cable.*

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Everything electrical summed up in three letters—A.E.G.—the symbol of one of the most progressive electrical factories in the world.

Not only are large stocks of all electrical goods ready for immediate delivery, but technical experts are always ready to advise.

Current lists, prices and fullest information may be had on application to :—

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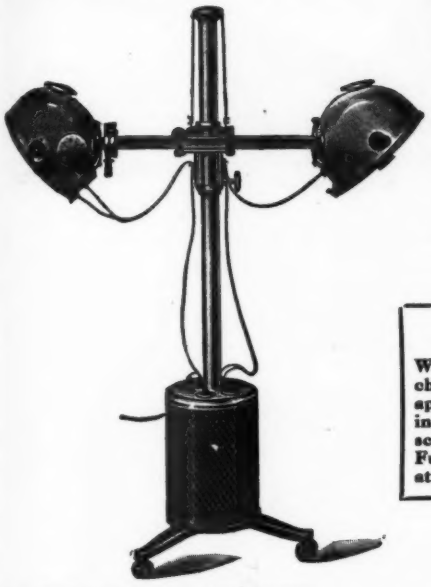
TELEGRAMS { INLAND : "AEGMACHAPP, SOWEST, LONDON." FOREIGN : "AEGMACHAPP, LONDON."

TELEPHONE : VICTORIA 8071-8072.

# ULTRA-VIOLET LIGHT



## BUY DIRECT FROM THE MAKERS

*Send for Catalogue* No. 42

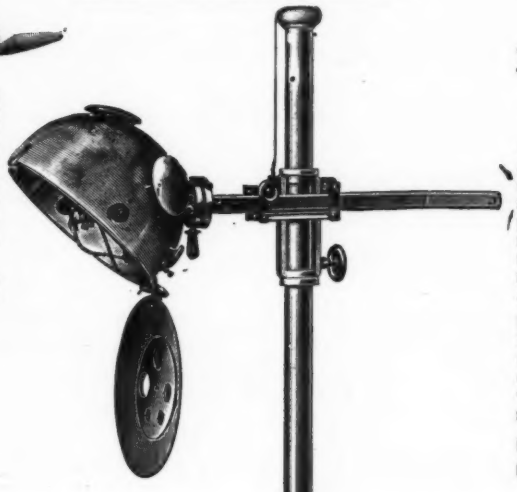
**WARNING!**

**We would urge that intending purchasers of any ultra-violet light apparatus (small or large) should insist on examining by a spectroscope the apparatus concerned. Full facilities for this are given at our showrooms.**

### THE "TRINITY" U-V. APPARATUS

Designed to provide the radiation of Tungsten Arc, Carbon Arc, and Mercury Vapour Arc, so providing a selection of radiations at the will of the operator. Both lamps can be run simultaneously when desired, permitting of two or more patients being treated at the same time.

**PRICE,** for direct current **£41 : 0 : 0**
**PRICE,** for alternating current **£53 : 12 : 0**



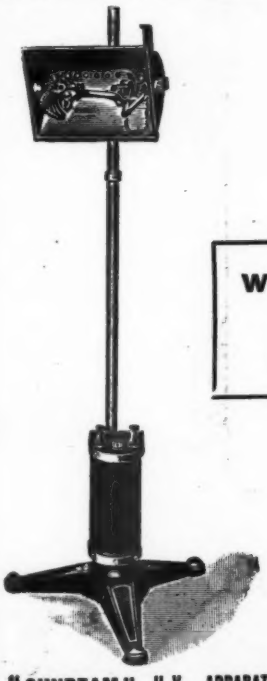
### THE "MEDISUN" U-V. APPARATUS

***Running Cost : 30 Treatments for Threepence.***

The 'MEDISUN' Ultra-Violet Light Apparatus is of the quartz mercury vapour type. It has been so designed as to eliminate all unnecessary expense, and yet provide an efficient source of ultra-violet radiation, quick in its reaction speed, not requiring adjustment, and foolproof in its mechanical details.

Whilst the price of the "Medisun" is quite low, its appearance is really first-class. Manufactured in polished aluminium throughout, it does not require frequent cleaning, is designed to stand on any table, weighs only 14 lbs., and is a thoroughly reliable piece of apparatus.

**PRICE,** for use on direct current - **£10**
**PRICE.** for use on alternating current **£18**



**WHOLESALE RETAIL EXPORT**

**BRITISH MADE THROUGHOUT**

### THE "SUNBEAM" U-V. APPARATUS

Designed for HOME USE, the Quartz Mercury Vapour Burner is less powerful than our other Models and consumes less current.

**PRICE,** for use on direct current **£17 : 0s.**
**PRICE,** for use on alternating ,, **£29 : 10s.**

### THE Dr. PERCY HALL U-V. APPARATUS

Unquestionably the most popular model for PROFESSIONAL USE, fitted with Quartz Mercury Vapour Burner, and mounted on a well engineered stand, providing all the necessary adjustments for local or general applications.

***Designed by a Doctor for the use of Doctors.***

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**PRICE,** for use on alternating current **£51**

### THE "JESIONEK" U-V. APPARATUS

Designed for whole body and group treatments only.

Suitable for SCHOOLS, HOSPITALS, INSTITUTIONS, BATHS, ETC.

**PRICE,** for use on direct current **£31 : 0 : 0**
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**WE CAN SUPPLY ALL MODELS FROM STOCK**

# THE MEDICAL SUPPLY ASSOCIATION LTD.

***Actual Makers of Ultra-Violet Radiation Apparatus of every Type.***

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Telephone: TERMINUS 5432 (6 lines).

**TO THE TRADE.** We are the ACTUAL MANUFACTURERS of ALL KINDS of X-RAY and ELECTRO-MEDICAL APPARATUS and INVITE YOUR INQUIRIES. Catalogues covering complete range of apparatus, with trade terms, post free.

# FOR OVERHEAD POWER TRANSMISSION

SOLID COPPER WIRE

STRANDED COPPER WIRE

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CADMIUM COPPER STRAND

STEEL-CORED ALUMINIUM STRAND

all in long lengths

## FREDERICK SMITH & CO

INCORPORATED IN THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LTD

**ANACONDA WORKS, SALFORD,** Near MANCHESTER

*Associated with*

The LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED

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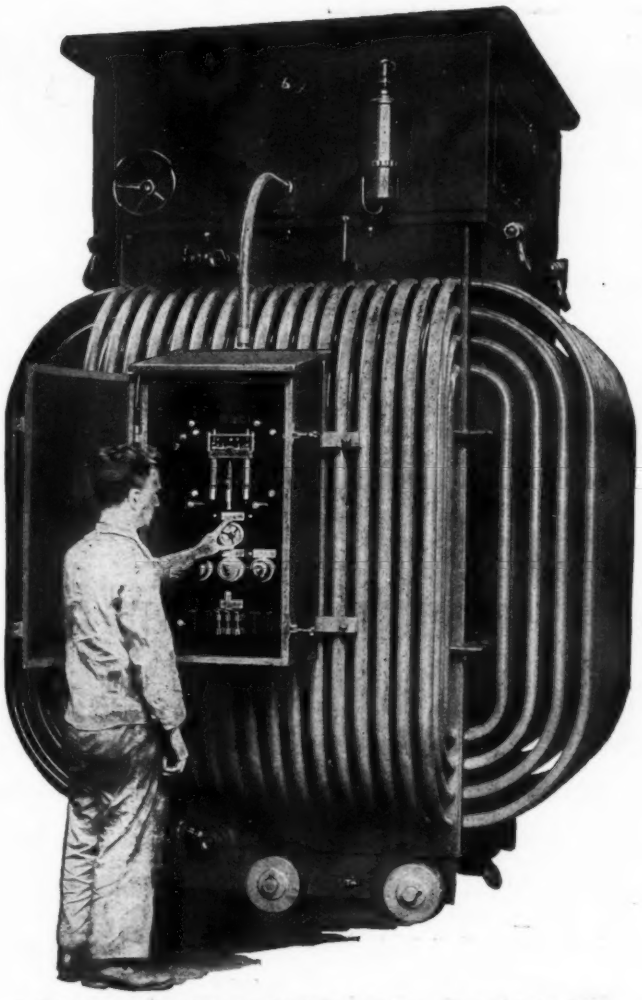
# Large Induction Regulators



S. & C. Outdoor Type Induction Regulator controlling voltage of 3,500 K.V.A. Supply Circuit. Incoming 10,000 to 13,000 Volts. Outgoing 11,000 Volts, Three-phase, 50 Cycles. Height, 11 ft.; Length, 9 ft.; Width 7½ ft.; Weight with Oil, 12½ tons.

**SWITCHGEAR AND INDUCTION REGULATORS**

**BY INSTALLING S. & C. Induction Regulators to maintain a constant voltage you obtain**

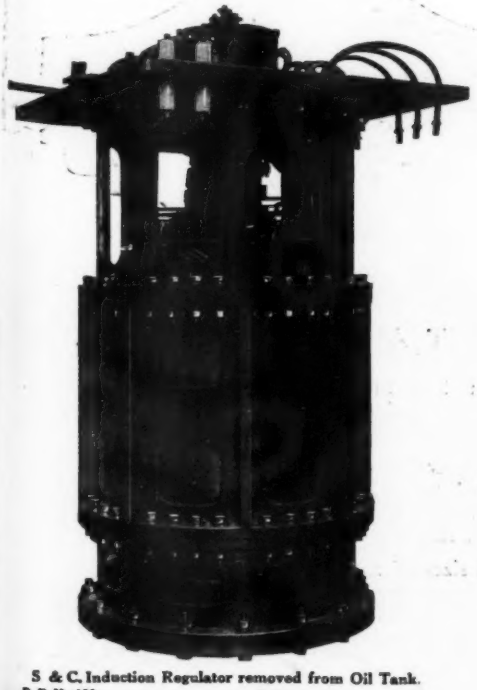
**Increased Revenue**
**Efficient Distribution**
**Satisfied Customers**

**The latest developments in design and construction are embodied in S. & C. Induction Regulators some of the features being improved control gear, totally enclosed top-plate and silent, consistent operation.**

**MORE than 25 years ago S. & C. made the first Induction Regulator in Great Britain *and it is still in operation.* Since then large numbers have been supplied, the photo below indicating the wide range of sizes covered by S. & C. designs, Polyphase and Single Phase (patented).**

**SWITCHGEAR & COWANS Ltd**
**Old Trafford Manchester**

**District Offices and Representatives throughout Great Britain and Overseas.**
**London Office: 28, Victoria St., S.W.1**



S & C. Induction Regulator removed from Oil Tank.
*D.R.K. 166.*

Group of S. & C. Induction Regulators showing partial Range of Sizes.

# —1,212 PER CENT.—

## You will be certain to come to it.

| WORLD'S PRODUCTION OF ALUMINIUM. | | |
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| 1905. | 1925. | Per cent. |
| Tons. | Tons. | increase. |
| 16,197. | 210,000. | 1,212·0. |

"The challenge of aluminium to the other non-ferrous metals, and indeed to steel, has only begun, but already the placing of this metal in the ranks of the principal industrial metals must be regarded as one of the outstanding metallurgical achievements of the period whose progress I am about to review."

Prof. H. C. H. CARPENTER, Ph.D., F.R.S.
James Forrest Lecture 1927.

## Be certain to come to us:

**William Mills, Ltd.,** Grove Street, **Birmingham** *Aluminium Founders since 1892*

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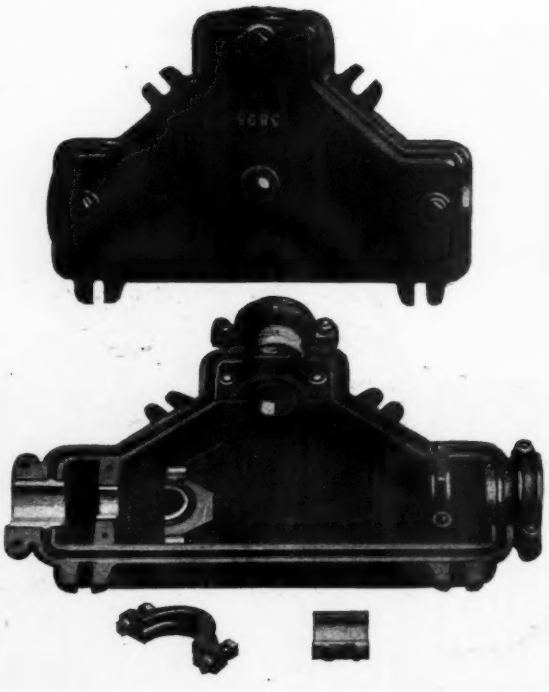


**JOINT AND SERVICE BOXES.**

Cast Iron Straight Joint and Tee Service Boxes, provided with cast lead bonds for both lead and armour of cable.

Lead service boxes with long jointing nozzles, bored to suit lead of cable, and cast iron protection covers, or complete boxes fitted with cast iron armour clamps.

All sizes of 2, 3 or 4-core cables.

**W. LUCY & CO., Ltd.,** EAGLE IRON WORKS, **OXFORD.**

Tel. Address: "CLIFFORD, BIRMINGHAM." ESTABLISHED 1776.

TRADE MARK.

# CHARLES CLIFFORD & SON, LTD.
# BIRMINGHAM.

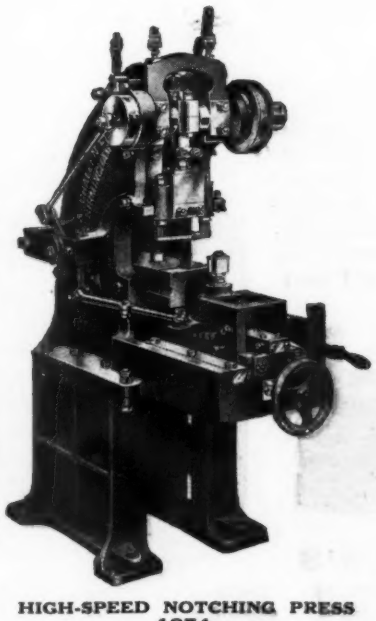
*Contractors to Admiralty, War Office, and Principal Railway Companies.*

## COPPER, BRASS AND PHOSPHOR BRONZE SHEETS, TUBES, RODS, AND WIRE.

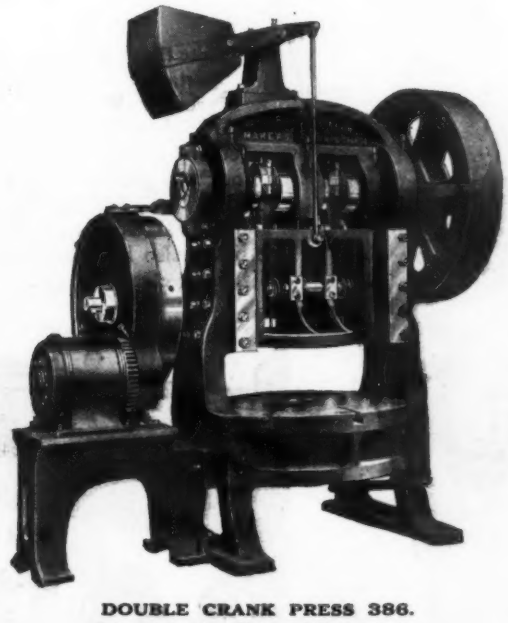
PHOSPHOR TIN 5%, and PHOSPHOR COPPER 10% and 15% Phosphorus.

**MANGANESE BRONZE, YELLOW METAL and NAVAL BRASS.**
**TIN, LEAD, ZINC, and COMPO WIRE and STRIP.**
**Chill-cast PHOSPHOR BRONZE BARS, Solid and Cored. "Seacliff" Brand.**

# TAYLOR & CHALLEN PRESSES



**HIGH-SPEED NOTCHING PRESS 1274.**
400 to 620 Notches per minute in discs from 17 down to 3½ inches diameter. Rate of Notching depends on size of disc and angle between Notches.



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Cuts out Armature Plates and Segments, etc.

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**DERWENT FOUNDRY. WORKS and SHOWROOMS: CONSTITUTION HILL, BIRMINGHAM.**
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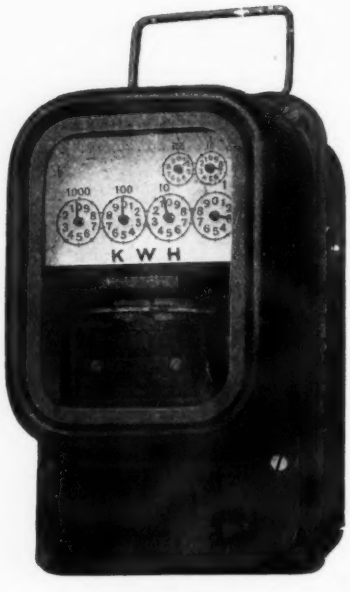
Telephone: Birmingham: Central 376. London: Victoria: 3513.

# FERRANTI

## ALTERNATING CURRENT METERS




Type FDc.
5 amp. : 10 amp.

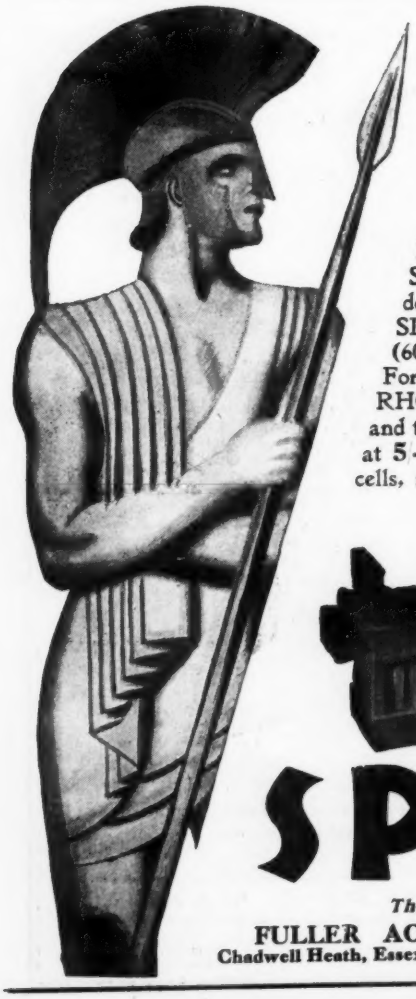
**For small consumers whose demand may be from 20 watts to 3 Kw. it is important to record every unit, otherwise there is a loss of money which is a goodly percentage of that consumer's account.**

**It is still more important to instal a meter which needs no attention.**

## FERRANTI LTD.,

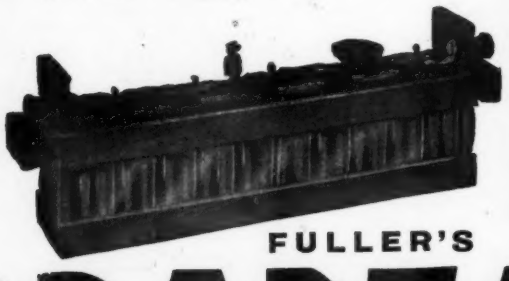
MAKE RELIABLE METERS AT

HOLLINWOOD, : LANCASHIRE.



# UNFLINCHING AS A SPARTAN

Like the Spartans of ancient Greece, Fuller's Sparta batteries never flinch. Robust to a degree, they are the ideal radio batteries. SDG glass cell (2 v., 25 a.h.) 5/6. LDG (60 a.h.) 9/6. SW types for bright valves. For H.T. there are two brilliant batteries—RHG, 20 v., 3,500 milliamp.-hours at 15/-, and the MHG, 10 v., 3,000 milliamp.-hours at 5/-. Also loud speakers, dry and inert cells, sack elements, etc.



FULLER'S

# SPARTA

*The battery that never flinches.*

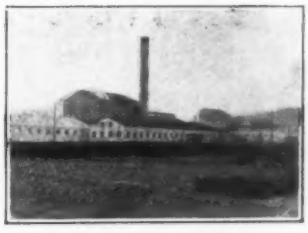
FULLER ACCUMULATOR CO. (1926), LTD.,
Chadwell Heath, Essex. *'Phone; Seven Kings 1200. Wires: Fuller, Chadwell Heath.*

FULLER'S BALKITE trickle-charger 37/6

T.A.S.

HOUSE WIRING.

STREET LIGHTING.



FACTORY WIRING

# A Reminder

IT is now more than twelve years since the Macintosh Cable Co., Ltd., introduced its unique and now well-known dielectric "Maconite" to the electrical industry.

"Maconite" Cables are now installed wherever difficult conditions exist, and the demand for them to-day is so great that a large new factory is being built.

Some of the uses for which "Maconite" Cables are now in demand are illustrated on this page.

The Cable Makers' Association, recognising the merit of "Maconite," has now standardised cables of this type.

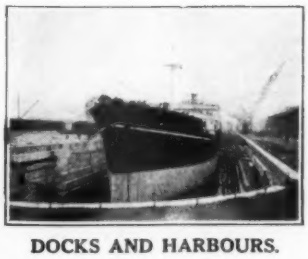
*Specify the original*

## "Maconite"

## INSULATED CABLES

*Manufactured by :—*

**THE MACINTOSH CABLE CO., LTD., DERBY.**



DOCKS AND HARBOURS.

RAILWAYS.

SHIPS.

M. 194.

# It's easy to sell—

Thor

ELECTRIC

## Washers and Wringers Automatic Ironers and Vacuum Cleaners

As selling propositions Thor Electric Household Machines have two main advantages over other types. They are incomparably the best obtainable for workmanship, finish and efficiency. They are already in use by a million satisfied householders.

These popular easy selling appliances are supported with National advertising. The Thor guarantee, the Thor demonstration and Thor sales assistance ensure handsome worth-while profits without increasing your overheads.

*Write to-day for further information.*

**HURLEY MACHINE COMPANY,**
**245, Oxford Street - - LONDON, W.1.**

# THE JACKSON 'JUNIOR' ELECTRIC COOKER

Cat. No. 50 J.

The most important feature of this little Cooker is that the Grill-Boiler Plate *is quite independent of the Oven, therefore it is not necessary to take a cake out of the oven to grill a chop or toast some bread, or to clean out the oven after using the Grill as is the case with some small cookers.*

It is made in cast iron and steel, and the exterior black parts are all stove enamelled except the Hob, which is "Marblon" mottled enamelled in the famous Jackson leadless vitreous enamel.

This wonderful little Cooker is *not a toy*—it is a real Cooker in miniature.

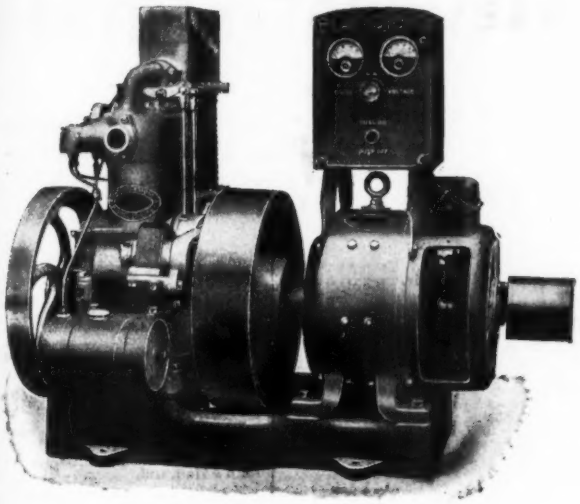
## PRICE £5 11 6

The oven will cook a 5-lb. leg of mutton and a pudding at one time, for the heating elements are arranged to give the maximum cooking space. The hob contains a Grill-Boiler Plate which will keep four large saucepans boiling, and toast or grill at the same time.

*Write for particulars:*

**The Jackson Electric Stove Co., Ltd.,**
**143, SLOANE STREET, LONDON, S.W.1.**

Telephone: SLOANE 6248 (3 lines). Telegrams: "Cookelec, Phone, London." Works: Luton, Beds.



A "BLACKSTONE" Petrol-Electric Plant.

# "BLACKSTONE"
## *Electric Lighting and Power Plants*

**In addition to Crude-Oil Engine Generator Plants, 3 to 400 Kilowatts, we now supply Petrol-Electric Plants with the following outputs:—**

## *1, 1½, 2½ & 3½ Kilowatts.*

**These sets consist of our latest type No-Trouble 4-stroke Petrol-Engine (fitted with overhead valves and automatic carburetter) direct coupled to a Dynamo and mounted on a baseplate common to both.**

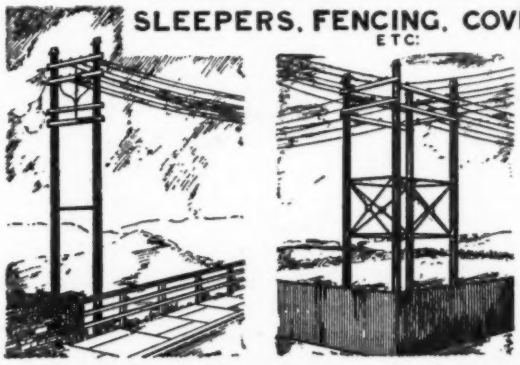
**Switchboards can be supplied mounted on the set or separate. Storage Batteries for use in conjunction with the sets are also supplied.**

**Write to-day for full particulars and prices (Post Free).**

**BLACKSTONE & CO., LTD.,**
**(Electrical Dept. F) :: Stamford, Lincs.**

# CREOSOTED WOOD POLES.

SLEEPERS, FENCING, COVER BOARDS, ETC.



## ARMSTRONG, ADDISON & Co

*Telegraphic Address, "Timber," Sunderland.*

SUNDERLAND.

*Established 1853. Telephones, 1812 & 1813.*

Complete Set with full instructions. Price **7/6**
The Lamp alone, **2/6**

## ANOTHER USE FOR FLUXITE

the paste flux that **SIMPLIFIES SOLDERING.**

# HARDENING TOOLS AND CASE-HARDENING

**A beautiful bright glass-hard surface without scale.**

***Ask for Leaflet on Improved Methods.***

Of all Ironmongers in tins, **8d., 1/4** and **2/8.**

FLUXITE, LTD., (Dept. 54), West Lane Works, West Lane, ROTHERHITHE, S.E. 16.

# KANDEM

METERS. FITTINGS. LANTERNS. ARCLAMPS. TRANSFORMERS.

KORTING & MATHIESEN ELECTRICAL Ltd
711 & 715 FULHAM Rd
S.W.6

## THE "DURIE" SCREWING MACHINE FOR ELECTRIC CONDUIT

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**CRAVEN ROAD, LEEDS.**

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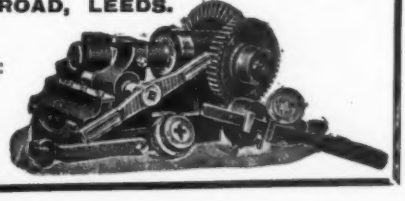

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# 'ELO' TESTS AS RIGOROUS AS THE 'TRIAL OF THE PYX'

## 'Trial of the Pyx' by jury at the British Mint

One coin from every 15 lbs. of gold minted and one coin from every 60 lbs. of silver minted is deposited throughout the year in the 'Pyx,' there to await the annual trial of the 'Pyx.'

Since the time of James the First a jury consisting of Freemen of the Company of Goldsmiths has been entrusted with the duty of examining the coins deposited in the chest or 'Pyx.' This yearly trial takes place under the direction of the King's Remembrancer, and the verdict recording the results of the several tests releases the Officers of the Mint from their responsibility in regard to the coinage, and affords a public guarantee that the standard of the coins is fully maintained.

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'ELO'

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*Write for our free and interesting Literature which will give you further information.*

## BIRKBYS LIMITED

**LIVERSEDGE, YORKS.**

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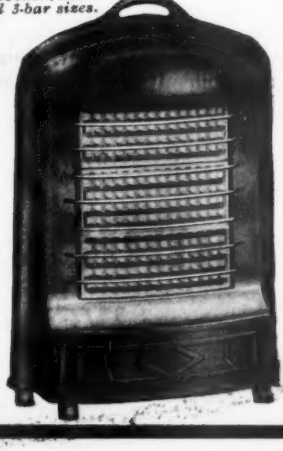

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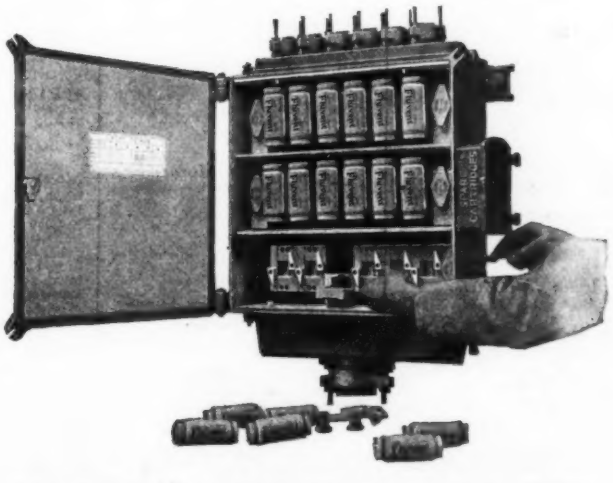

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# CLASSIFIED INDEX OF ADVERTISEMENTS.

The names of Advertisers whose Announcements are ordered for a series are entered under any one Heading in this Index Free of Charge, but if repeated under existing headings **1s.** per week is charged for each additional entry.

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Rawlplug Co.
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Moy, Ernest F., Ltd.

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British Aluminium Co., Ltd.

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The London Elec. Firm.

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Hobdell, Way & Co., Ltd.

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Wheatley Kirk, Price & Co.

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General Electric Co., Ltd.
India-Rubber, G. P. & T. W. Co., Ltd.
Morris, J. R.

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Accumulator Makers' Association:—
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Yarrow & Co., Ltd.

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Telegraph Condenser Co., Ltd.

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Constructors, Ltd.

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Electric Control, Ltd.
Ellison, George.
General Electric Co., Ltd.
Veritys, Ltd.

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Peebles (Bruce) & Co., Ltd.

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Jenkins, W. J., & Co., Ltd.

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Yorkshire Copper Works, Ltd.

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CONTINUED ON PAGE L.

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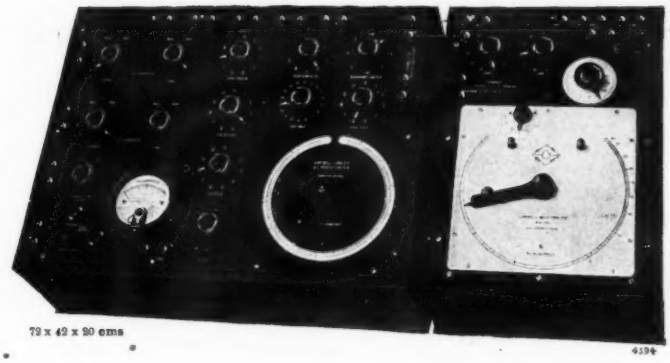
# A.C. POTENTIOMETER

**(Larsen Type.)**



72 x 42 x 20 cms 4594

**This new potentiometer, designed by Mr. Albert Campbell, is a development of the original Larsen pattern. It enables direct readings of both the in-phase and quadrature components of an unknown A.C. voltage to be obtained. In-phase voltages up to 1·8 volt can be read to an accuracy of about 0·01 millivolt, while the quadrature component is read on an improved form of inductometer having a range up to 1 volt and readable to about 2 microvolts.**

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are distributed through the 21 depots of the Edison Swan Electric Co. Ltd.
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C.7.

# CLASSIFIED INDEX OF ADVERTISEMENTS.—*(Continued from page xlviii).*

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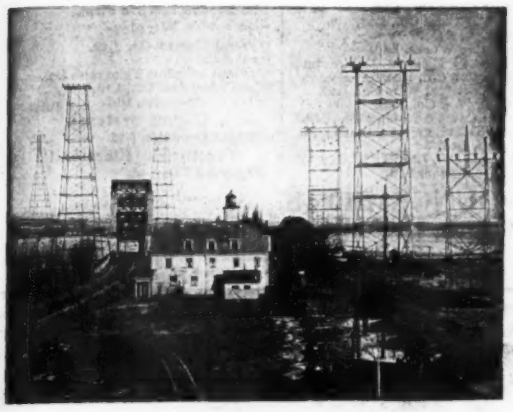

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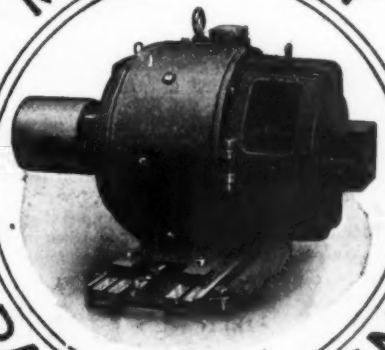

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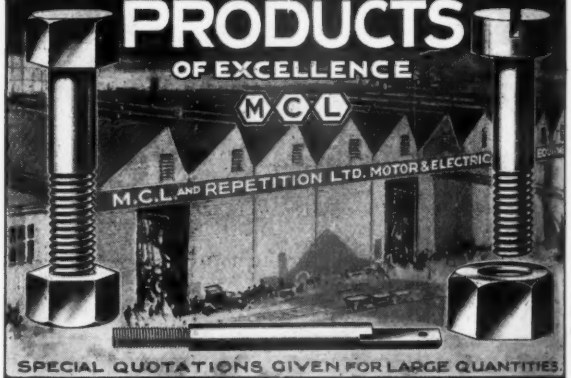


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> *"Portable fittings . . . the only metal parts of which are the guards surrounding the lamp or lamps, need not be earthed . . . provided that these guards are not, and cannot come, in metallic contact with the lampholder or lampholders. Such fittings shall be made of treated hardwood, or of some suitable non-ignitable composite material capable of withstanding rough usage . . ."*

Possibly "treated" hardwood in a hand-lamp is that kind of wood meant to be treated with respect when in use in damp places. However, there's no ambiguity about

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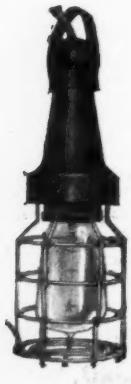

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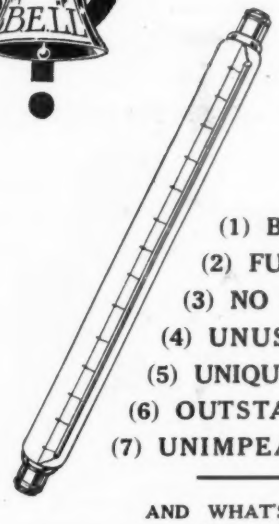

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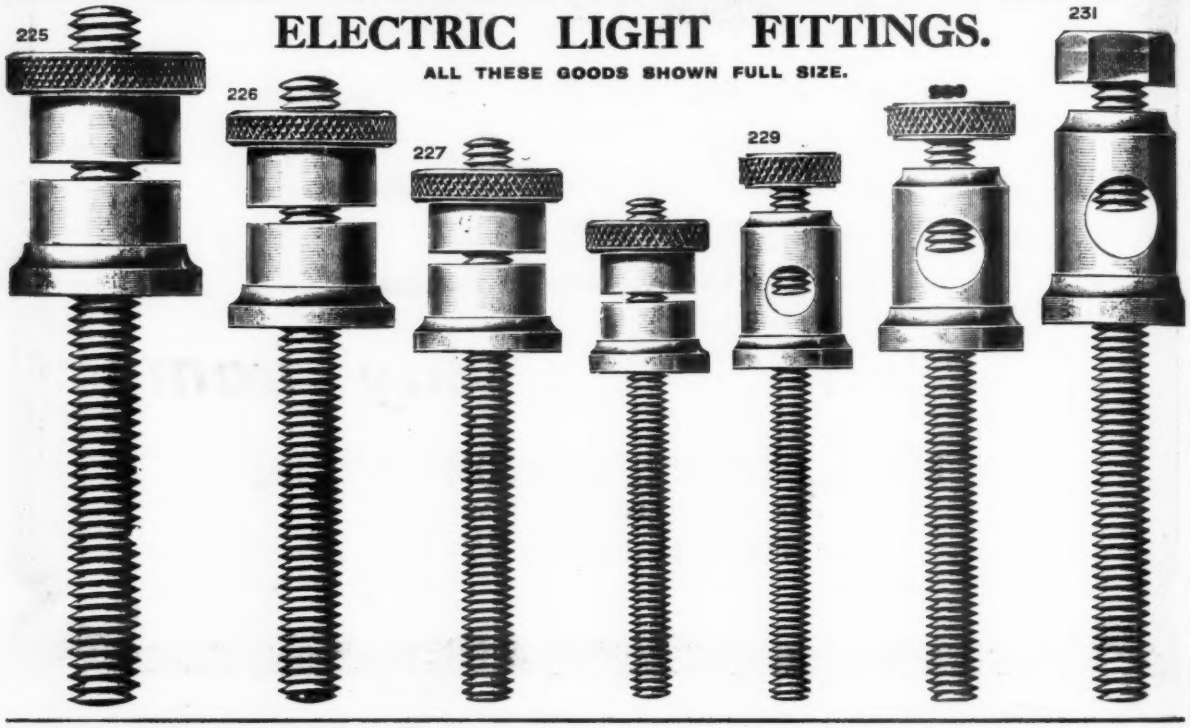

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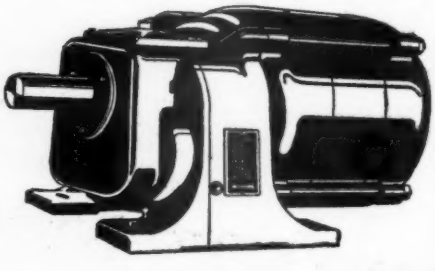

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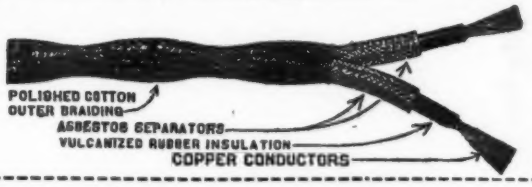


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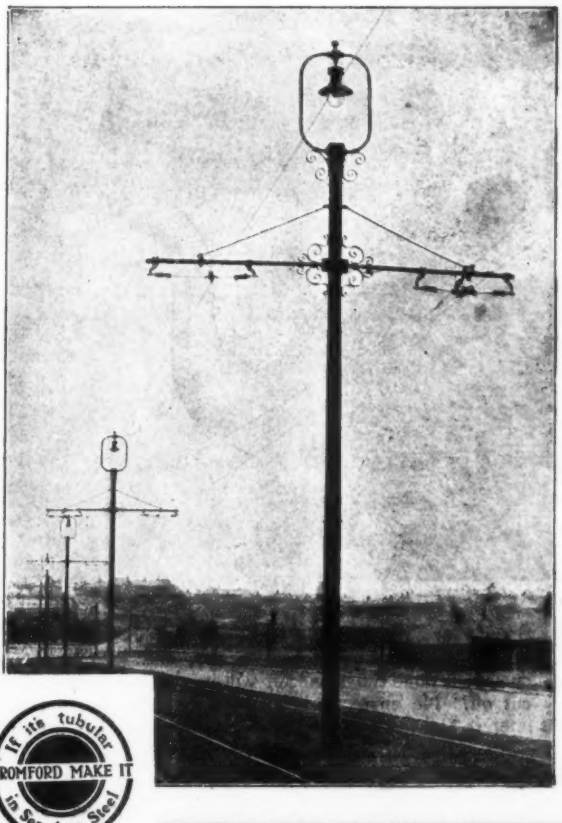

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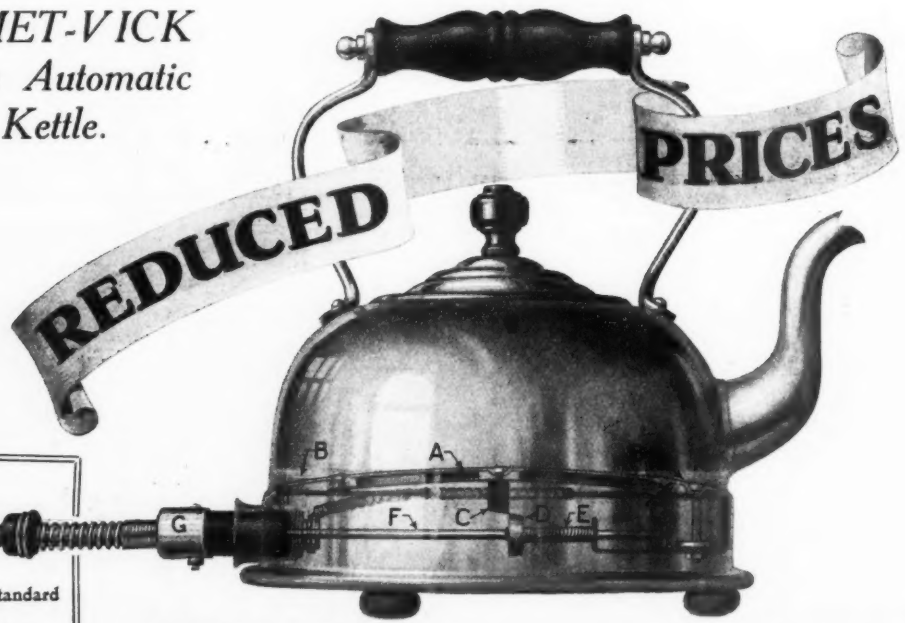
*The MET-VICK Electric Automatic Safety Kettle.*




**PRICES**

Supplied for all standard voltages.

| POLISHED COPPER. | |
|---|---|
| 2 pint | 3 pint |
| **30/-** | **37/6** |

| NICKEL PLATED. | |
|---|---|
| 2 pint | 3 pint |
| **32/6** | **40/-** |

## SIMPLICITY ITSELF . . .

Show your customers how effectively the safety device works. It can actually be switched on dry, and long before any damage is done the connector will be shot out and the supply cut off. No spare parts, switches or fuses are necessary. This demonstration always arouses interest, and the new reduced prices, shown on left, will prove a further inducement to buy.

***Overprinted Price Lists on Request.***

**METRO-VICK SUPPLIES LTD., 155, Charing Cross Road, LONDON, W.C.2.**

(Proprietors: METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED.)

8C
8 09

# DUST REMOVAL & COLLECTION

Dust is caught at the point of generation by—

TRADE SIROCCO MARK

## DUST REMOVAL PLANTS

Other important features are correctly proportioned ductwork that keep down the friction losses.

An efficient and reliable Fan capable of dealing with dust of every description without risk of choking.

Collectors that have a low resistance and are capable of trapping a very high proportion of every kind of air-borne dust.

**Davidson & Co. Ltd. Sirocco Engineering Works, Belfast**

LONDON, MANCHESTER, CARDIFF, BIRMINGHAM, GLASGOW, NEWCASTLE, BRISTOL.

*The Swing Fire.*

# Making Certain

After we have wished you every success and prosperity for 1929, make certain of a record year by selling PREMIER Appliances.

They meet the public taste.

Every PREMIER Appliance appeals to the pride in possession and the artistic taste of the prospective purchaser.

Bring yourself success and prosperity by selling PREMIER Appliances.

Write TO-DAY for Literature.

# PREMIER

ELECTRIC HEATERS, LTD.,

*Electric Heating Engineers,*

BIRMINGHAM.

Telephone: VIC. 821-2.

Telegrams: "FAHRENHEIT," Birmingham.

The Lampholder that is . . . . .
-EASY TO WIRE UP
-SECURE WHEN WIRED
-LOW IN COST
-SUITABLE FOR HEAVY CURRENTS

# EMVEE LAMPHOLDER & Cordgrip

The increasing use of larger lamps and the many types of electric home helps calls for cord-grips and lampholders, which offer a high degree of security against faults and give long service under strenuous conditions. Such are the features of "Emvee" Lampholders, Cordgrips and Ceiling Plates, as instanced by the special features enumerated above.

The "Emvee" Lampholder has a wide field of application and is particularly suitable for positions where chemical fumes are present, or where heavy vibrations obtain.

Envelope series 4130/1 gives full information and prices of the "Emvee" Lampholders, Cordgrip and Ceiling Plates.

METRO-VICK SUPPLIES, Ltd.
155, Charing Cross Road,
LONDON, W.C.2.

A few of the regular users of the "Emvee" Lampholder and Cordgrips.

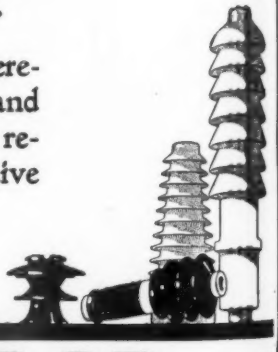
SD 98

# PORCELAIN ACCESSORIES

Minute accuracy is the first consideration in the making of all our porcelain accessories. That is essential to efficiency and speed in assembling the complete article.

This degree of accuracy, combined with high vitrosity and great durability, is always obtainable in our products.

Place yourselves, therefore, in our hands and be assured that your requirements will receive individual attention.



# TAYLOR TUNNICLIFF

AND COMPANY, LIMITED.

Head Office: EASTWOOD, HANLEY, STAFFS.

*Telephone: Hanley 5272.*
*Telegrams: Eastwood, Hanley.*

London Office: 110, CANNON ST., E.C.4.

*Telephone: City 6620.*

# PROGRESS

THE CONTINUED PROGRESS AND EXPANSION OF OUR ACTIVITIES HAS COMPELLED THE

# REMOVAL

OF OUR LONDON BRANCH TO MORE EXTENSIVE AND COMMODIOUS PREMISES, WHICH ON AND AFTER *DECEMBER 28th*, WILL BE SITUATED AT

## 30, GT. QUEEN STREET,

(OFFICES AND SHOWROOMS)

AND

## 26-28-30-PARKER ST., KINGSWAY, LONDON, W.C.2.

(TRADES ENTRANCE).

THE EXTRA FACILITIES AFFORDED BY THIS CHANGE WILL ENABLE US TO GIVE ADDED SERVICE TO THOSE OF OUR VERY MANY FRIENDS WHO IN THE PAST HAVE GIVEN US THEIR SUPPORT.

## A COMPREHENSIVE RANGE OF

ELECTRIC "Revo" SPECIALITIES

INCLUDING - - - ELECTRIC COOKERS . FIRES . IRONS WASHBOILERS . WATER HEATERS . KETTLES . STREET LIGHTING STANDARDS AND BRACKETS . INDUSTRIAL AND STREET LIGHTING FITTINGS . FUSE AND SWITCHGEARS . FANS . VACUUM CLEANERS LOUD-SPEAKERS, ETC., ETC.

Telephone: TIPTON 131—134 P.B.Ex.

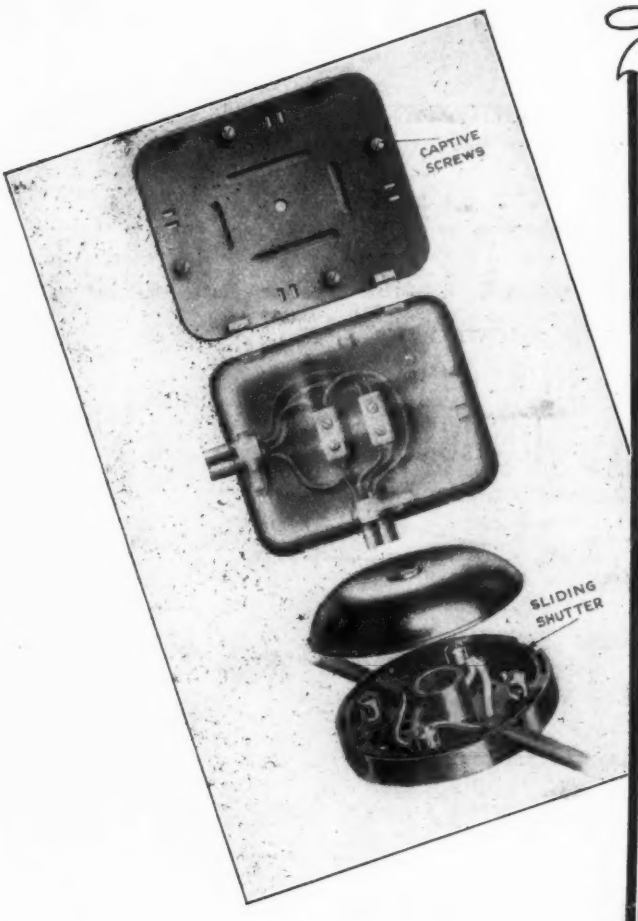
**REVO ELECTRIC CO., LTD.,**

Telegrams: "REVO, TIPTON."

BRITANNIA WORKS, TIVIDALE, TIPTON, STAFFS.

Depots: LONDON, 30, GT. QUEEN STREET. GLASGOW, CARDIFF. NEWCASTLE-ON-TYNE, &c.

one of the J.&P. pages



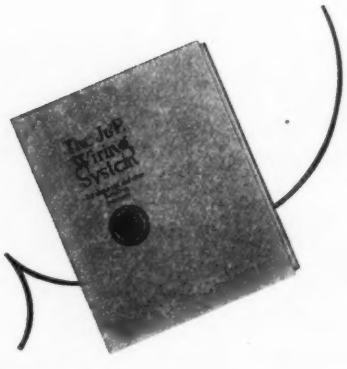

# A Sound System

We have too much respect for the wires and cables we manufacture to link them up with sardine tins and paper clips, and call the result a wiring system.

The joint boxes and bonding fittings of the **J. & P. WIRING SYSTEM** (metal-sheathed type) are made of heavy gauge sheet brass, thoroughly tinned.

For the T.R.S. type, the joint box is a handsome and substantial production of moulded bakelite.

In either case there is ample room to make all connections solidly and quickly.




*Write for Catalogue H.W.1.*

## Johnson & Phillips, Ltd.

**Charlton, London, S.E.7.**

*Branches in London (City), Birmingham, Bristol, Cardiff, Derby, Glasgow, Ipswich, Liverpool, Manchester, Newcastle, Portsmouth and Belfast.*

The mark that means that "little more" in quality

one of the J.&P. pages

# Your best Seller

"Episodes at Elmdene" has proved a best seller. Not only in the Edgar Wallace sense, though several editions have already been called for, but in the results secured by many contractors who have circulated the booklet. It does sell wiring.

THE

**J. & P. WIRING SYSTEM**

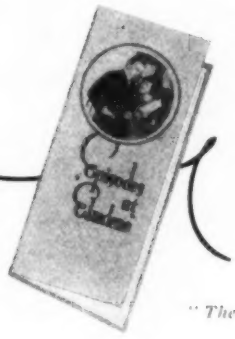
is here presented in a way which makes an irresistible appeal in the home, particularly to the lady of the house. Once you have her on your side, the order is as good as booked.

Get a supply of this "best seller" immediately for distribution in your district, overprinted with your own name and address.

## Johnson & Phillips, Ltd.

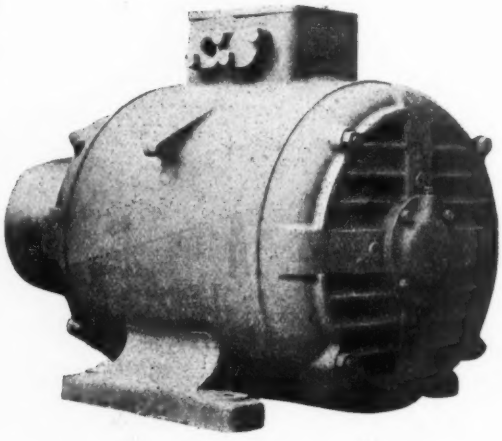
**Charlton, London, S.E.7.**

*Branches in Sydney, Melbourne, Wellington, Johannesburg, Durban, Ipoh, Calcutta and Bombay.*



*"The book of words.*

The mark that means that "little more" in quality



# AC
## "Witton"
# Motors

# The G.E.C. Your guarantee

# DC
## "Witton"
# Motors

*Manufacturers:*
**THE GENERAL ELECTRIC CO., LTD.**
*Head Office:* **Magnet House, Kingsway, LONDON, W.C.2.**
*Branches throughout Great Britain and in the principal markets of the World.*

**MADE IN ENGLAND**

# DISPLAYED ADVERTISEMENTS

**ADVERTISERS will please note that NEW COPY and ALTERATIONS to existing Advertisements (with Blocks) should reach here not later than**

**THURSDAY MORNING**

**OF THE WEEK PREVIOUS TO ISSUE.**

OFFICIAL NOTICES, PATENT NOTICES, SITUATIONS VACANT, SITUATIONS WANTED, PARTNERSHIPS, AGENCIES, ARTICLES FOR SALE, ARTICLES WANTED, ETC.

**Latest Time 5 p.m. TUESDAY.**

**The ELECTRICAL REVIEW is the recognised Medium of the Electrical Trades, and has BY FAR THE LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.**

## WHEATLEY KIRK, PRICE & CO.

**Have for close upon 80 years Specialised in**

**VALUATIONS AND SALES BY AUCTION of Electrical Works, Plant and Equipment.**

| LONDON: | MANCHESTER: | NEWCASTLE-ON-TYNE: |
|---|---|---|
| 46, Watling St., E.C.4. | 16, Albert Square. | 26, Collingwood Street. |

## SITUATIONS VACANT.

**Latest time for receiving, 5 p.m. Tuesday.**

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

**Original Testimonials should never be sent.**

### CROWN AGENTS FOR THE COLONIES.

**Colonial Government Appointments.**

APPLICATIONS from qualified candidates are invited for the following posts:—

Engineers as shown below are required by the Government of Nigeria for the Electrical Branch of the Public Works Department for two tours of from 12 to 18 months each, with prospect of permanency. Salary £600 a year, rising to £720 a year by annual increments of £30, and thence to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Free quarters and passage and liberal leave on full salary.

ELECTRICAL ENGINEER (M/1222).

Candidates, age 27 to 35, must be qualified to take charge of construction, and afterwards, of supervision of one or more electrical undertakings. They should have had a sound technical and practical training, and experience with high tension 3-phase systems, including pole line distribution.

MECHANICAL ENGINEER (M/1225).

Candidates, age 27 to 35, must possess certificates equivalent to those required for Associate Membership of the Institution of Mechanical Engineers; have had a thorough theoretical and practical training in mechanical engineering, including apprenticeship in an engineering works; and have had experience in the supervision of the erection and maintenance of Babcock boilers, Belliss type steam engines, alternators, condensing plant and pumps. They should also have some electrical knowledge.

Apply at once by letter, stating age and full particulars of qualifications and experience, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting the reference number against the appointment for which application is made. 4480

### PLUMBER-JOINTER

REQUIRED immediately, Plumber-Jointer, experienced in jointing on paper insulated, lead covered, and steel tape armoured multi-core cables, e.h.t and l.t. Preference will be given to a man conversant also with V.B. cables laid on the whole system.

Applications, giving details of experience and accompanied by copies of recent testimonials, to be addressed to Mr. G. F. Nayler, Borough Electrical Engineer, Electricity Works, Nelson, Lancashire. 4465

## SITUATIONS VACANT.—*Continued.*

### METROPOLITAN ASYLUMS BOARD.

THE Board invite applications for the appointment of:—

(1) Temporary Third Class Mechanical Engineering Draughtsman, and

(2) Temporary Third Class Electrical Engineering Draughtsman,

in the Department of the Engineer-in-Chief. Candidates must be between the ages of 20 and 25 years; for the appointment of (1) they must have had experience in an engineer's office and must be capable of preparing working drawings for steam boiler plant, hot water supply, and heating installations, &c.; for the appointment of (2) candidates must have had experience in an electrical engineering contractor's office and be capable of preparing working drawings for the installation of electric light and power, telephones, &c., in connection with large institutions. Salary £165 per annum. The appointments are subject to the provisions of the Poor Law Officers' Superannuation Act, 1896.

Forms of application can be obtained on and after Tuesday, January 1st, 1929, by forwarding stamped addressed foolscap envelope to the Clerk to the Metropolitan Asylums Board, Victoria Embankment, E.C.4. Completed forms to be addressed to the Engineer-in-Chief, Metropolitan Asylums Board, Sheffield House, Sheffield Street, W.C.2, so as to reach him not later than ten a.m. on Thursday, 10th January, 1929.

ALLAN POWELL,
Clerk to the Board.

4479

### FULHAM BOROUGH COUNCIL.

**Consumers' Clerk—Electricity Department.**

APPLICATIONS are invited for the appointment of Clerk in the Electricity Department in Grade "A" of the Council's service. Salary £55 per annum, plus bonus (at present £22), rising by annual increments of £10 per annum to a maximum of £95 per annum, plus bonus. A minimum educational standard is required.

A knowledge of book-keeping is essential, and preference will be given to candidates having some knowledge of work appertaining to electricity supply.

Forms of application and full particulars of the appointment will be sent to intending applicants on receipt of a stamped addressed envelope.

Applications, accompanied by copies of not more than three recent testimonials, must be delivered to the undersigned not later than Saturday, January 5th, 1929.

WILFRED TOWNEND,
Town Clerk.

Town Hall, Fulham, S.W.6.
December 21st, 1928. 4478

### BOROUGH OF LEIGH.

**Electricity Supply Department.**

APPLICATIONS are invited for the post of Male Assistant in the Electricity Department's Showroom. Applicants should have a knowledge of electricity, the use of consumers' electrical appliances, be a good salesman, and experienced in window dressing.

Commencing salary, £4 per week.

Applications (accompanied by copies of not more than three testimonials), stating age, qualifications, &c., to be received by the undersigned not later than the 7th January, 1929.

J. B. HUDSON, A.M.I.E.E.,
Borough Electrical Engineer.

"Albion House,"
Bradshawgate, Leigh, Lancs. 4459

## SITUATIONS VACANT.—*Continued.*

### METROPOLITAN BOROUGH OF STOKE NEWINGTON.

**Electricity Department.**

MAINS ASSISTANT.

APPLICATIONS are invited for this post at a salary of £200 per annum, rising by annual increments of £25 to £300 per annum.

Candidates must have had practical experience with l.t. 3-wire d.c. and 4-wire a.c. networks, including the laying of services.

The person appointed will be required to act under the Technical Assistant and his duties will include the keeping of mains sketch books. Ability to make neat and accurate sketches is essential.

Experience with e.h.t cables and transformer sub-stations will be an advantage.

The position will not be wholly supervisory.

The successful candidate will be required to reside within the Borough, pass a medical examination, and contribute to the Council's Superannuation Scheme.

Applications, with particulars of age, training, experience, and enclosing copies of three recent testimonials, should be delivered to the undersigned not later than the first post on January 3rd, 1929.

HEDLEY LARGE,
Borough Electrical Engineer.

Electricity Offices,
Edwards Lane, Church Street, N.16. 4481

### COUNTY BOROUGH OF STOCKPORT.

**Electricity Department.**

MAINS SUPERINTENDENT.

APPLICATIONS are invited for the post of Mains Superintendent in the Corporation's Electricity Undertaking.

The person appointed is required to act under the Borough Electrical Engineer and to take control of static sub-stations, e.h.t. and l.t., a.c. and d.c. mains laying and maintenance, and general responsibility for the lay-out and organisation of the whole distribution system.

Applicants must have received a sound technical education and practical training, and must have had practical experience in similar work.

Salary in accordance with the National Joint Board Schedule for the Electricity Supply Industry, Class G, Grade 4.

Applications, giving full particulars of age, training and experience, present and previous appointments, accompanied by copies of three recent testimonials, to be addressed to the Chairman of the Electricity Committee, Town Hall, Stockport, endorsed "Mains Superintendent," to be received not later than first post Wednesday, January 9th, 1929.

R. LOMAX,
Borough Electrical Engineer.

Electricity Offices,
23, Tiviot Dale, Stockport. 4444

**Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three consecutive Insertions for the price of two, if ordered and prepaid with first insertion.**
**Box Number and ELECTRICAL REVIEW address count as seven words.**

APPOINTMENT vacant for Manager of large engineering factory in London district. Factory engaged on mass production of electrical and other technical apparatus. Applicants must have previous experience in factory management, including control of technical staff and all labour matters and special knowledge of organising repetition work, and bringing new designs into production. Excellent house and garden provided adjacent to factory. State salary.—Write "K.K.," c/o J. W. Vickers & Co., Ltd., 24, Austin Friars, E.C.2. 8413

DESIGNER required for delicate measuring electrical instruments and relays; good prospects.—Age, experience, married or single, and salary required, to 4458, Electrical Review, 4, Ludgate Hill, London.

DESIGNER wanted (age not under 28) capable, by training and experience, of undertaking the design of e.h.t. circuit breakers of heavy rupturing capacity.—Apply by letter, giving full particulars, to Switchgear & Cowans, Limited, Old Trafford, Manchester. 4345

DRAUGHTSMAN-Designer for Admiralty control gear for electric motors.—State qualifications, age and salary expected, to 8411, Electrical Revieew, 4, Ludgate Hill, London.

DRAUGHTSMAN required with experience in the design of ironclad switches and detail apparatus.—Apply, stating age, experience, and salary required, The General Electric Co., Ltd., Witton, Birmingham. 4469

DRAUGHTSMAN, Senior, with first-class experience of steam turbine design and details.—Apply, stating age, experience, and salary required, to Manager, Drawing Offices, B.T.H. Co., Ltd., Rugby. 4352

## SITUATIONS VACANT.—*Continued.*

DRAUGHTSMAN required for the layout of e.h.t. and h.t. switch cubicles and l.t. switchboards.—Apply, stating age, experience, and salary required, to The General Electric Co., Ltd., Witton, Birmingham. 4441

DRAUGHTSMEN (several) required for the design of oil circuit breakers and compound filled switchgear.—Apply, stating age, experience and salary required, to The General Electric Co., Ltd., Witton, Birmingham. 4442

ELEC. Eng. Copy Writer for preparing publicity and specifications for manufacturers of electric plant.—Crompton Parkinson, Ltd., GSD, Bush House, Aldwych. 4467

ELECTRICAL Draughtsman, aged about 25, required for factory engineer's office; experience in a.c. and d.c. plant layout an advantage.—Write or call Employment Dept., Standard Telephones & Cables, Ltd., Colindale, N.W.9. 4483

ENGINEER for 100-volt, d.c. plant on country estate, comprising hydraulic turbine, oil engine and batteries.—Apply, stating age, wage and experience, to Mr. D. O. Evans, M.I.E.E., Electricity Works, Caernarvon. 4475

ENGINEERING Publicity. Important firm in S.E. England require assistance. Some engineering knowledge and publicity experience essential. Send concise statement of qualifications and, if possible, examples of work.—State age, salary required, and when able to commence, to 4464, Electrical Review, 4, Ludgate Hill, London.

ESTIMATOR required for dealing with manufacturing costs of switchgear and electrical accessories. Some experience of sign manufacture would be an advantage. State experience and salary required.—4468, Electrical Review, 4, Ludgate Hill, London.

EXPERIENCED Draughtsmen wanted, used to small electrical and mechanical apparatus.—Apply by letter only, stating full particulars, to Elliott Brothers (London), Limited, "Century" Works, Lewisham, S.E.13. 8420

FOREMAN for electrical repair shop in Midlands. Must be used to all classes of a.c. and d.c. rewinds and repairs. Preference to man with machine shop experience.—Apply by letter, giving full particulars and salary required, to 4374, Electrical Review, 4, Ludgate Hill, London.

FOREMAN, suitable to undertake care of pumps for electric lamp making.—Apply Fenn, 80, Edgware Road, W. 4453

JUNIOR Estimating Clerk for motor department. Technical experience necessary, knowledge of German desirable. Good prospects. Please state fully previous experience, giving references, and salary required.—4466, Electrical Review, 4, Ludgate Hill, London.

MACHINE Shop Foreman required, used to switchgear and radio work. Must have good experience in production in small quantities of special details combined with sound knowledge of mass production methods.—Write stating experience, age, salary required, Box 152, Sells, Fleet Street, E.C.4. 8419

MANUFACTURERS of high-class electric domestic appliances, chiefly cookers, fires, &c., require the services of a Representative in the London area. Applications will only be considered from gentlemen with well-established connections in this area, and who can produce first-class testimonials.—Applications, stating age, details of connection, and salary required, should be sent, in the first instance, to 8415, Electrical Review, 4, Ludgate Hill, London.

MARCONI'S Wireless Telegraph Co., Ltd., have vacancies at their Chelmsford Works for Test Room Assistants. Men with previous experience in power and receiver work only required.—Apply by letter to Works Manager, Marconi Works, Chelmsford. 4457

PLUMBER-Jointer, experienced in e.h.t., h.t., and l.t. cable work of all descriptions. No application will be considered from men over 25 years of age.—Apply, stating age, experience, Union of which applicant is a member, when free to commence, and enclosing copies of references, to 4378, Electrical Review, 4, Ludgate Hill, London.

PLUMBER-Jointer wanted, for ex. h.t., h.t., and l.t. mains work in a Yorkshire town; wages according to Joint Industrial Council scale.—Applications, stating age, training, experience, and present position, to 4360, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVE wanted for Manchester district by X-ray and electro-medical apparatus manufacturers; must be energetic and have established connection.—Write, giving full particulars, to 8348, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVE required for London and district by well-known firm of Bakelite Moulders; must have experience and connections in all trades.—4414, Electrical Review, 4, Ludgate Hill, London.

## SITUATIONS VACANT.—*Continued.*

SALESMAN, with good connection, required by reputable London firm of electrical manufactures for d.c. and a.c. standard and special plant. Good salary and commission to suitable man.—8382, Electrical Review, 4, Ludgate Hill, London.

SALES Representatives (two) wanted in London by leading manufacturers of accessories and ironclad gear. Only men of personality, first-class address and experience, with initiative and ability for selling quality products, need apply, giving full particulars of experience, age, and salary expected, to 4400, Electrical Review, 4, Ludgate Hill, London.

SALES Representatives required for principal centres in the Provinces by leading manufacturers of accessories and ironclad gear.—Only men of personality, first-class address and experience, with initiative and ability for selling quality products, need apply, giving full particulars of experience, district applied for, age and salary expected, to 4401, Electrical Review, 4, Ludgate Hill, London.

SEVERAL Vacancies exist for young men, 19-26 years of age, who have taken a diploma course in Electrical Engineering at a recognised technical college, or who have had a sound electrical training. Good prospects for those with the necessary qualifications.—Write, stating age and experience, to Employment Dept., Standard Telephones & Cables, Ltd., Hendon, N.W.9. 4461

THE British Engine, Boiler and Electrical Insurance Co., Ltd., 24, Fennel Street, Manchester, require a Junior Engineer for their Lift and Crane Department. Applicants should have good theoretical knowledge and be able to make dimension sketches. Some knowledge of correspondence. Age 21-25. Salary to commence £200 per annum.—Apply by letter only, marked "Cranes and Lifts," giving outline of experience, particulars of certificates of theoretical knowledge and copies of testimonials, Harry M. Longridge, Manager. 8410

WANTED for London, Electrical Engineer, capable of taking charge of electrical section of manufacturing business. Knowledge of a.c. work and ability to estimate and install small plants necessary. Age about 30.—State salary expected and qualifications to 8412, Electrical Review, 4, Ludgate Hill, London.

WANTED, experienced Switch Design-Draughtsmen for e.h.t. work; also Draughtsmen for layout of switchgear. Opportunities for good men.—Apply, stating experience and salary required, to English Electric Company, Stafford. 4477

WIRELESS Engineer required with experience in repairing, testing, maintaining and demonstrating wireless sets for both mains and battery operation. Age not under 25.—State experience, age and salary required, to 4296, Electrical Review, 4, Ludgate Hill, London.

## APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

PRINCE of Wales Power Station, Rotherham (Leading Stoker); Box 4238 (Lady Showroom Assistant); Box 4387 (Junior Engineer); Box 4368 (Manager); Box 4307 (Engineer Estimator).

## SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A BRILLIANT, capable Electrical and Mechanical Engineer (37) seeks position, Works Manager or Superintendent; up-to-date methods, tooling, designing, instrument, wireless, switchgear, &c., cooking and heating. Any district.—8378, Electrical Review, 4, Ludgate Hill, London.

A SMART young Electrician (25) desires change; 10 years' experience; lighting, all systems; motors installation and repairs; 'phones, &c. Rate 1s. 6d.—8417, Electrical Review, 4, Ludgate Hill, London

ADVERTISER (30), several years' selling experience domestic appliances, seeks post in sales department, home or export; commercial and technical knowledge of trade, also good knowledge French and Spanish.—8354, Electrical Review, 4, Ludgate Hill, London. 8354

AMBITIOUS Electrical Engineer, technical education, desires position as Assistant Mains Engineer. Fully conversant l.t. distribution, meters, domestic apparatus, hire of apparatus and wiring schemes, mains and consumers' records and general office routine.—8349, Electrical Review, 4, Ludgate Hill, London.

## SITUATIONS WANTED.—*Continued.*

CONTRACTORS.—Advertiser (38), unmarried, desires engagement; knowledge of overhead line construction, C.B. telephone apparatus.—8407, Electrical Review, 4, Ludgate Hill, London.

DISENGAGED Electrician (24); lighting and power; experienced on cinema installation, both electrical and mechanical; electric driven air compressors, and i.c. engines.—"Electrician," 18, Seagor Road, Sheerness. 8373

ELECTRICAL and Mechanical Engineer (33), wishes responsible position, home or abroad; 15 years' practical experience, industrial, domestic lighting, heating, and power contracts. Accustomed to drawing up own plans, specifications, and schedules, also supervising. Full details at interview.—8336, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Assistant, age 19 years, requires situation; 3 years' Polytechnic training, 2½ years' practical experience, new work, maintenance. Quick, keen and reliable.—Kindly write 8381, Electrical Review, 4, Ludgate Hill, London.

ENGINEER-Electrician, ex-Naval man, requires situation; 10 years' experience large estate electric plant; all repairs house lighting, hot-water work, central heating, pumping stations; handyman, drive lorry. Age 45, married (no children).—Blades, Polesden Lacey, Dorking, Surrey. 8405

MEASURING Instrument Test Room Engineer. At present in charge of a.c. test. Fully competent, capable organiser and good output man, age 37, seeks similar position.—8408, Electrical Review, 4, Ludgate Hill, London.

WIREMAN, good all-round, vacant.—J., 5, Dalberg Road, Brixton. 8416

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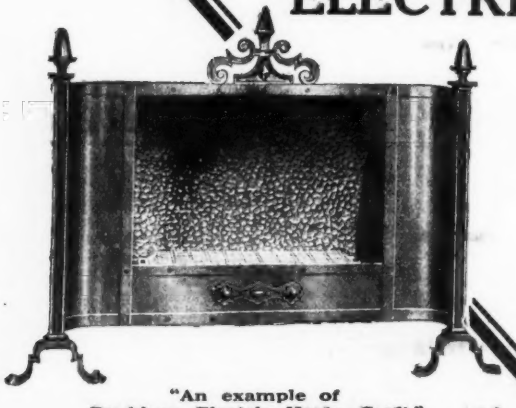

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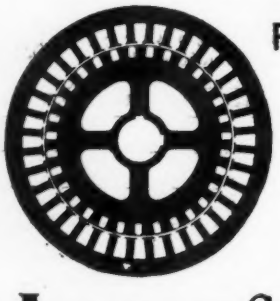

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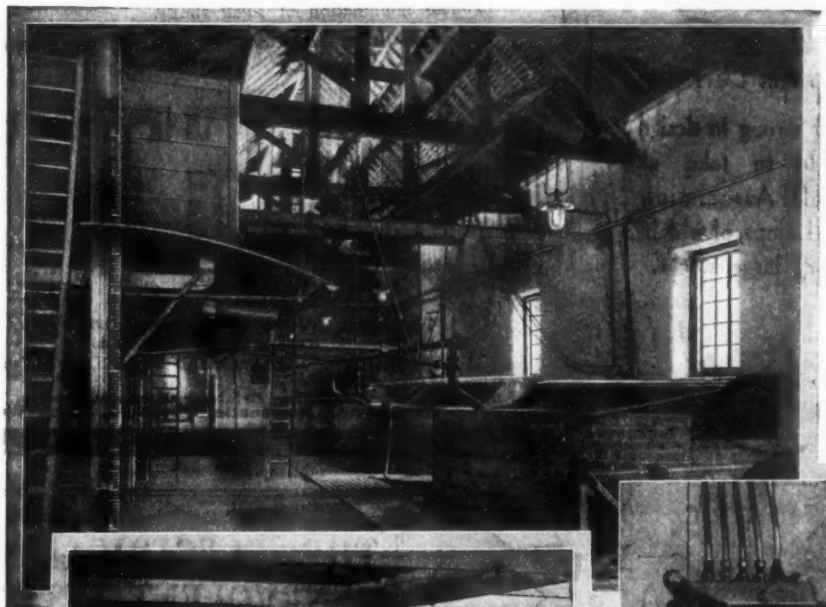

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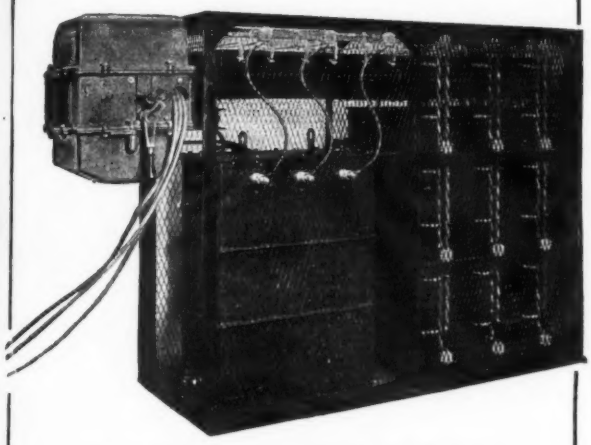

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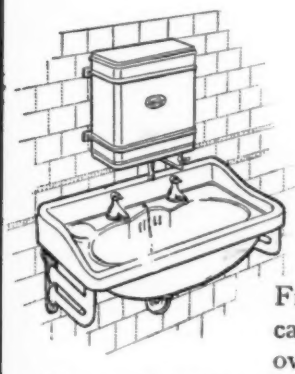

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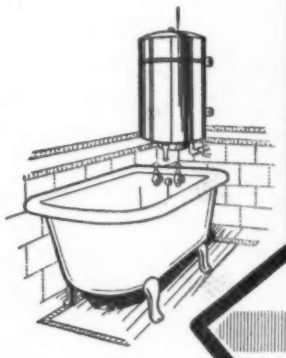

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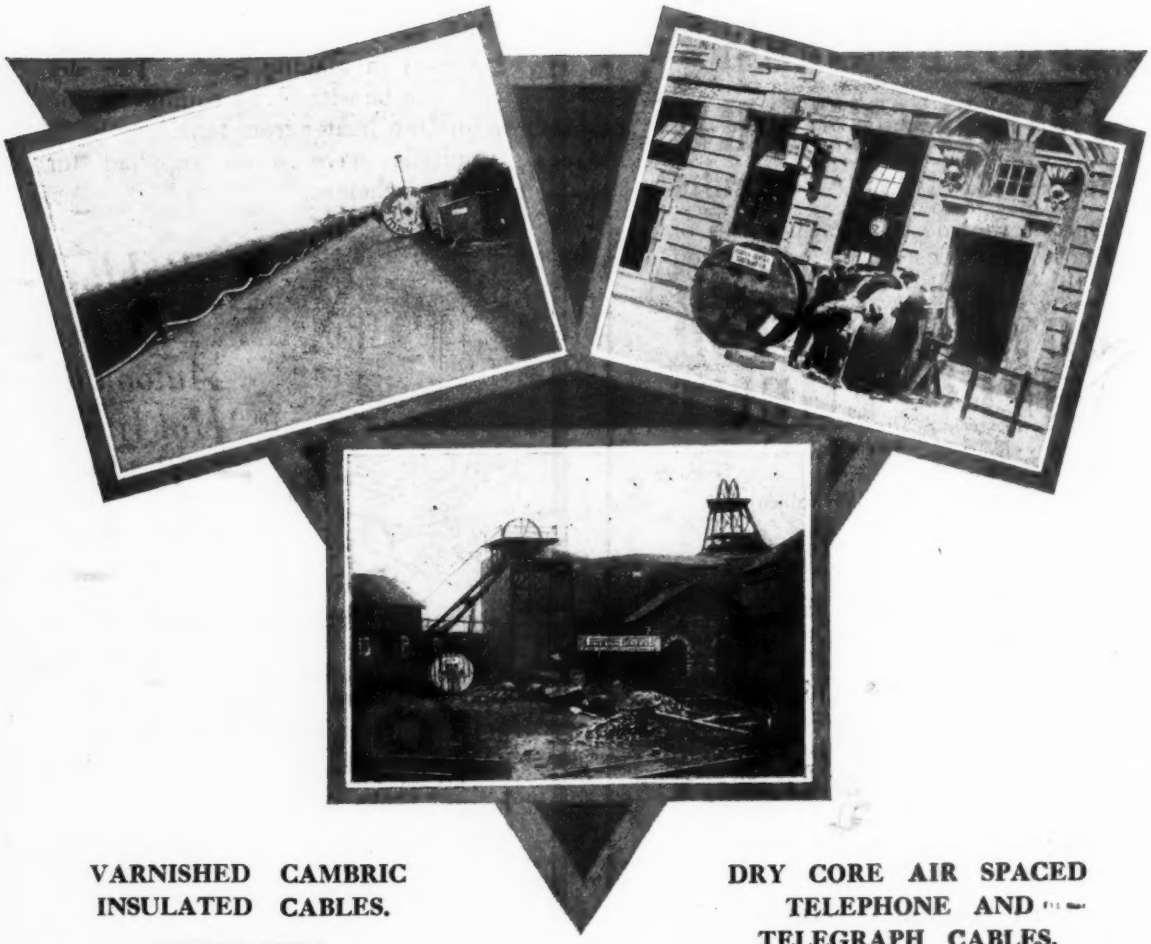

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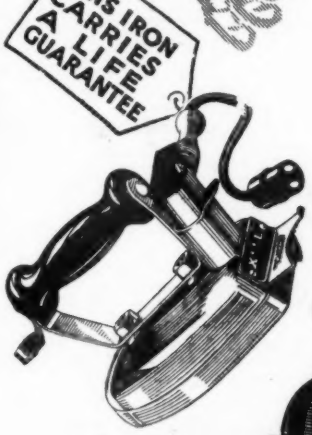


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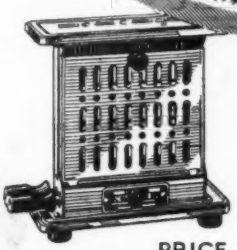

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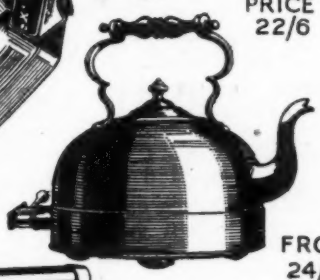

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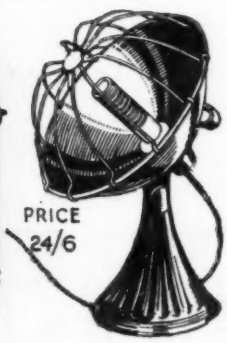

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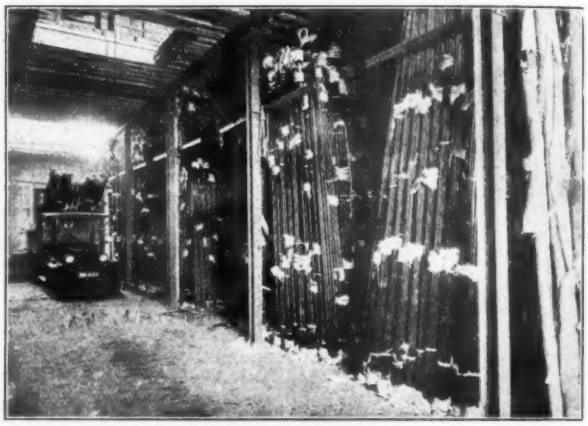

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Patent No. 21090/27.

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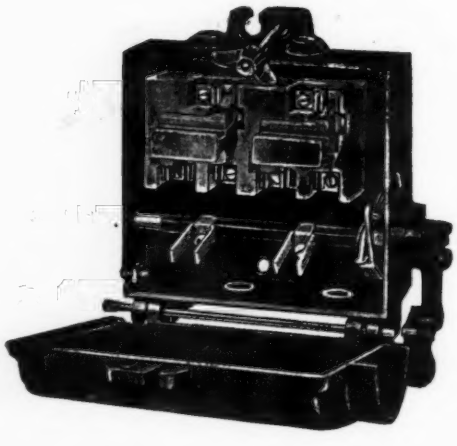

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| WEE-APEX | Covers are fixtures and cannot be opened until switch is in 'off' position. |
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| WEE-APEX | Fuses tested by the N.P.L. for compliance with the performance required by B.E.S.A. Specification No. 88 were entirely satisfactory. |

# FUSED SWITCH

**5-10 Amps. 250 Volts.**

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85-

## OFFICIAL NOTICES.

**Latest time for receiving, 5 p.m. Tuesday.**

### ASHFORD, KENT, URBAN DISTRICT COUNCIL.

THE Council are prepared to consider Tenders for a Solid Injection Heavy Oil Engine to drive a 600-kW, three-phase, 50 period Alternator. Tenderers should state cost of engine delivered and erected on Council's foundation block complete with two starting air bottles, and piping between these and engine (but no compressor). Water cooling pipes to end of foundation block (but no pump). Also to include fuel service tank and up to 30 feet of piping between this and engine. Tenderers may also state additional cost of fitting a Super-charger and the additional power which will be developed. Also efficient silencer and uptake pipe with the necessary supports at a distance of 20 ft. from nearest cylinder. Alternator will be of the bedplate type with two bearings. Tenderers to supply blue prints and to indicate the amount of foundation required. No further specification will be issued.

Also one Centrifugal Pump to run at 1,420 r.p.m. with 4-in. suction and delivery pipes to deliver 36,000 gallons per hour against a total head of 33 ft. Pump to have bare shaft extension suitable for direct coupling to Council's motor.

Also one 50-ton Cylindrical Tank suitable for fuel oil, diameter 9 feet, delivered on to site these works. Two manholes and one 4-in. and one 2-in. flange connections.

Tenders endorsed and addressed to J. Sudlow, Esq., Clerk to the Council, The Assembly Rooms, Ashford, Kent, to be in by Monday, January 14th, 1929, and the Council's Engineer will see representatives by appointment after that date.

The Council do not bind themselves to accept the lowest or any tender. 4412

### CITY OF MANCHESTER.

THE Electricity Committee of the Manchester Corporation invite tenders for the supply and delivery, during the period ending September 30th, 1929, of :—

Single-Phase, Alternating Current, Electricity Meters.

Specification and form of tender may be had on application to Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, on payment of a fee of one guinea, which amount will be refunded on receipt of a *bona-fide* tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall not later than 10-0 o'clock a.m. on Monday, January 7th, 1929.

The firm entrusted with the work will be required to enter into a contract to be prepared by the undersigned.

The Corporation do not bind themselves to accept the lowest or any tender.

H. DUNKS,
Acting Town Clerk.

Town Hall, Manchester.
December 21st, 1928. 4482

### BOROUGH OF KEIGHLEY.

**Electricity Department.**

THE Electricity Committee invite Tenders for the supply and erection of a Water-Tube Boiler capable of evaporating 30,000 lb. of water per hour.

The boiler must be of the horizontal tube type with tubes of not less than 4 in. external diameter suitable for a working pressure of 250 lb. per sq. in., complete with mechanical stoker and superheater, by which means a final temperature of 750 deg. is obtained.

Sealed tenders, endorsed with the name and address of the firm tendering and marked "Tender for Boiler House Plant at the Electricity Department," should be sent in to the Town Clerk, Town Hall, Keighley, not later than January 17th, 1929, and all such tenders must be registered.

Specifications can be obtained from the undersigned on receipt of a cheque for £2 2s., payable to the Keighley Corporation, which will be returned on receipt of a *bona-fide* tender. Additional copies can be obtained at £1 1s. per copy, which will not be returned.

The Corporation do not bind themselves to accept the lowest or any tender.

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Borough Electrical Engineer and General Manager.

Electricity Offices,
Coney Lane, Keighley.
December 18th, 1928. 4476


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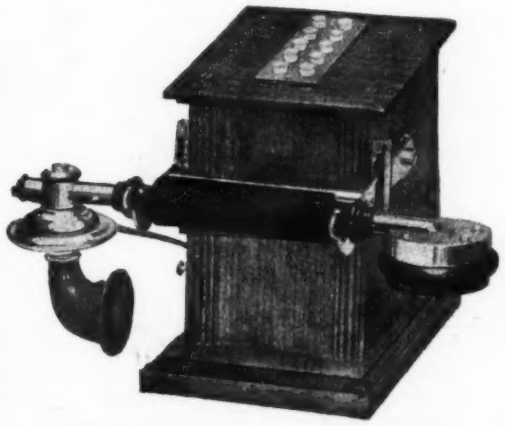

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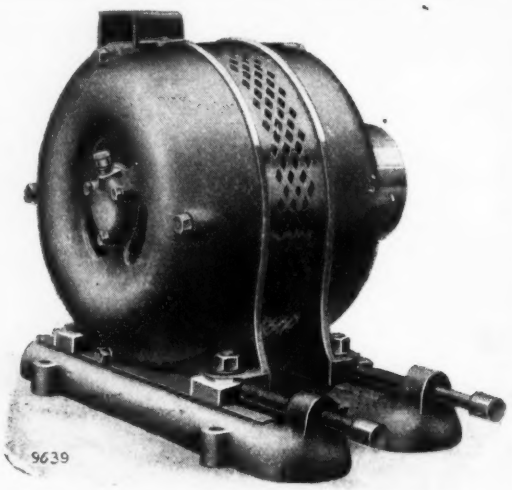


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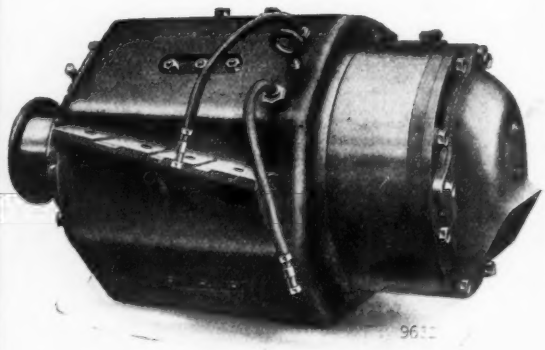

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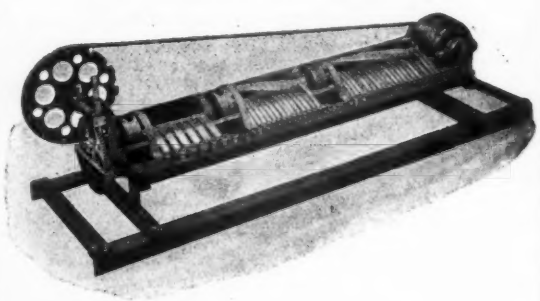

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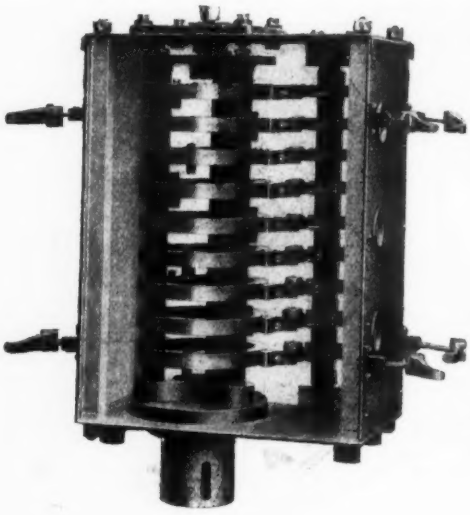

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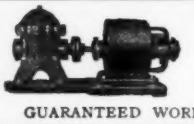

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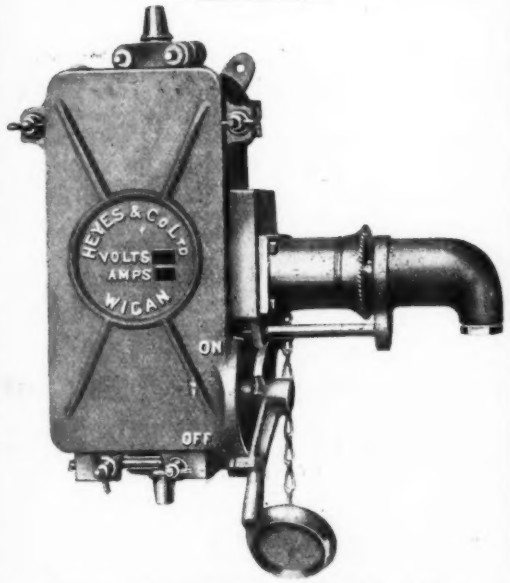


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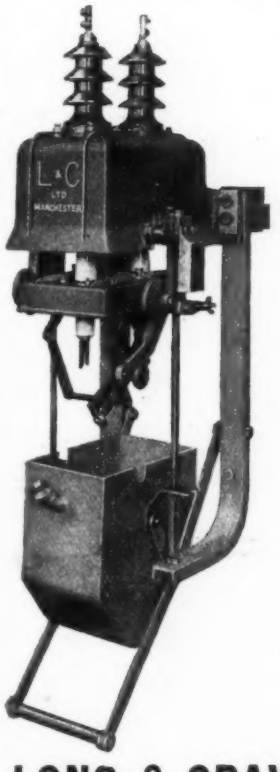


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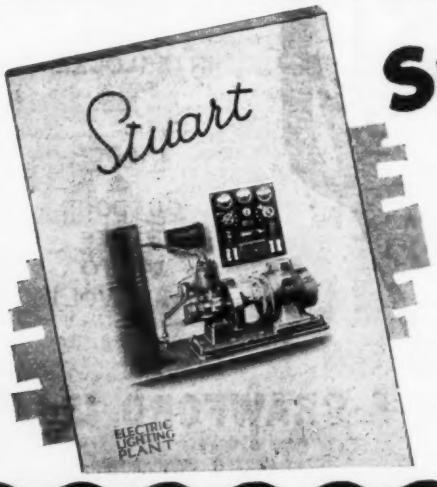


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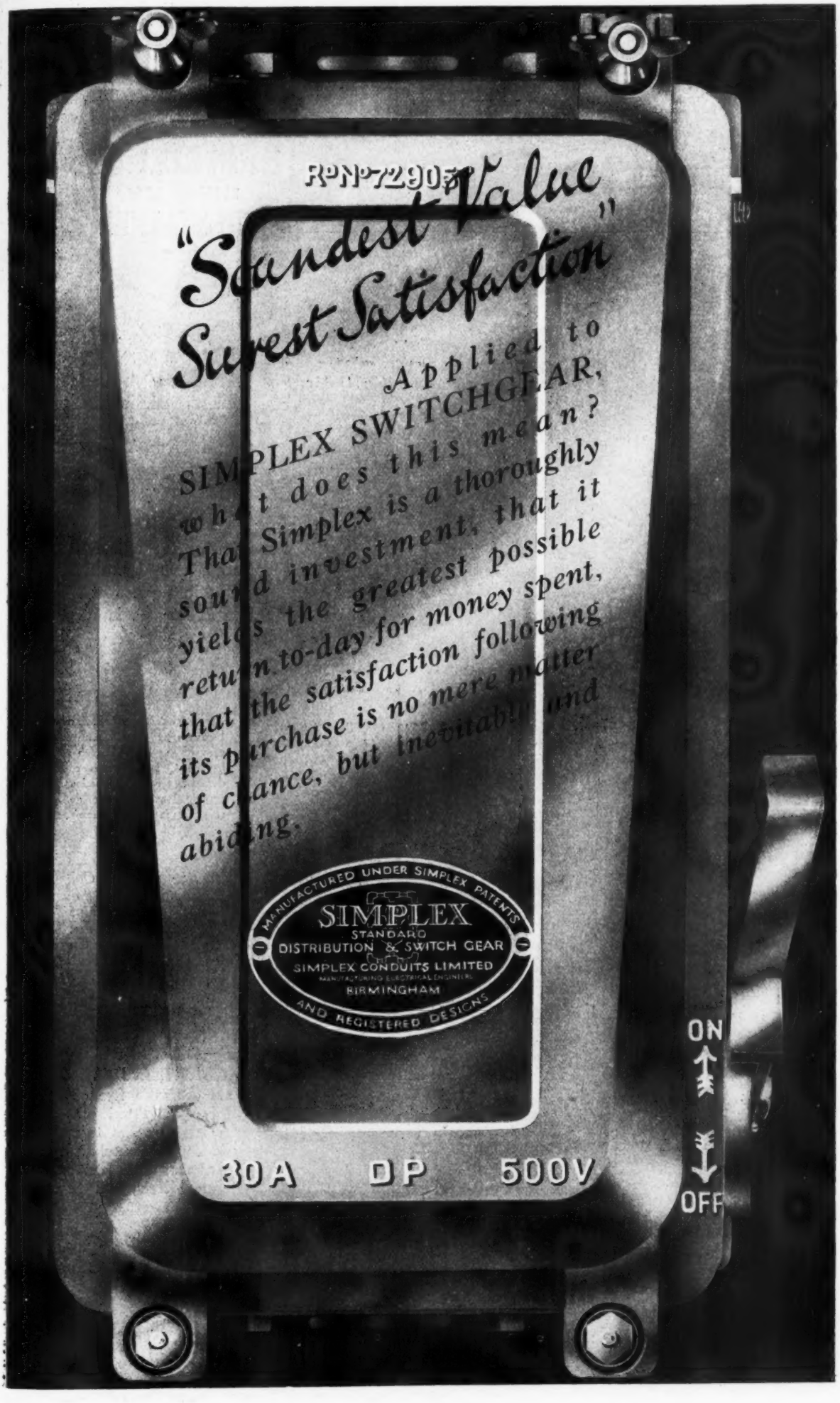
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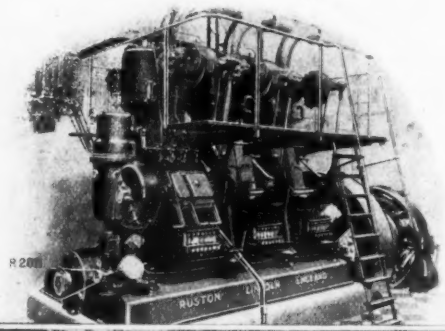

*Three Cylinder Ruston Heavy Oil Engine installed at the Works of The Lanston Monotype Corporation Ltd., in*

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**PROOF that the Efficiency of the Ruston Oil Engine is maintained in service year by year is evidenced by an order received from The Lanston Monotype Corporation Ltd., of Horley, Surrey, for a Six Cylinder unit.**

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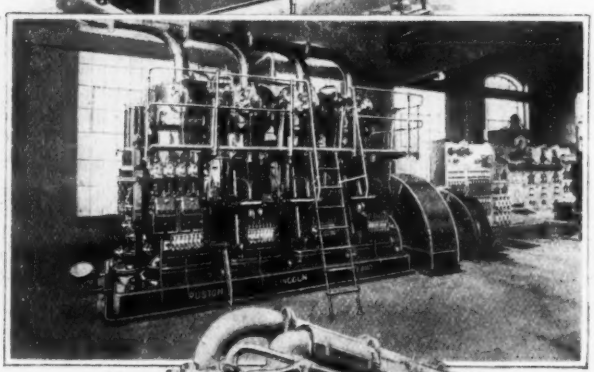

*Four Cylinder Ruston Heavy Oil Engine installed at the Works of The Lanston Monotype Corporation Ltd., in*

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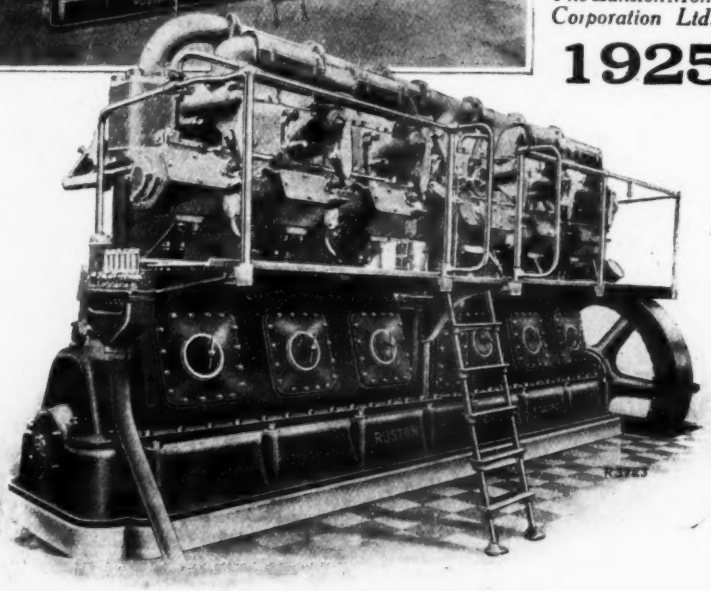

*The Ruston Six Cylinder Oil Engine illustrated alongside is representative of the Engine ordered by The Lanston Monotype Corporation Ltd., to be installed in*

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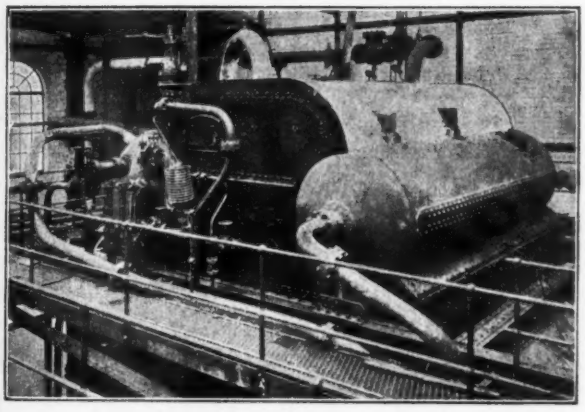

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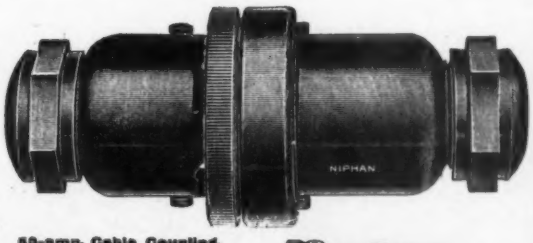


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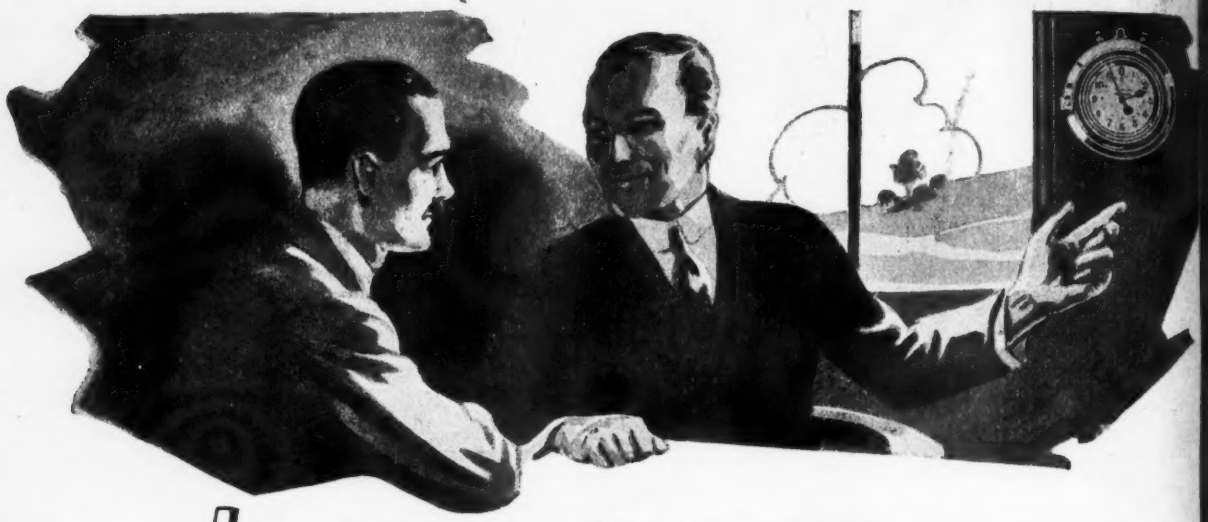

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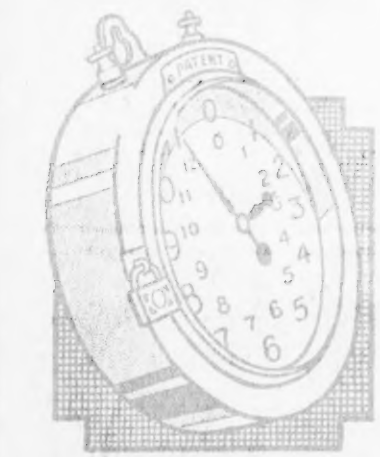

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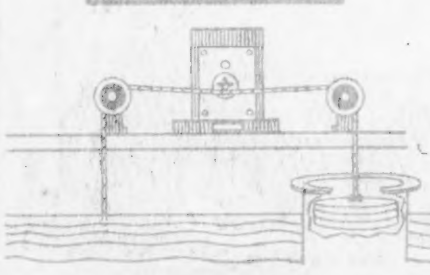

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